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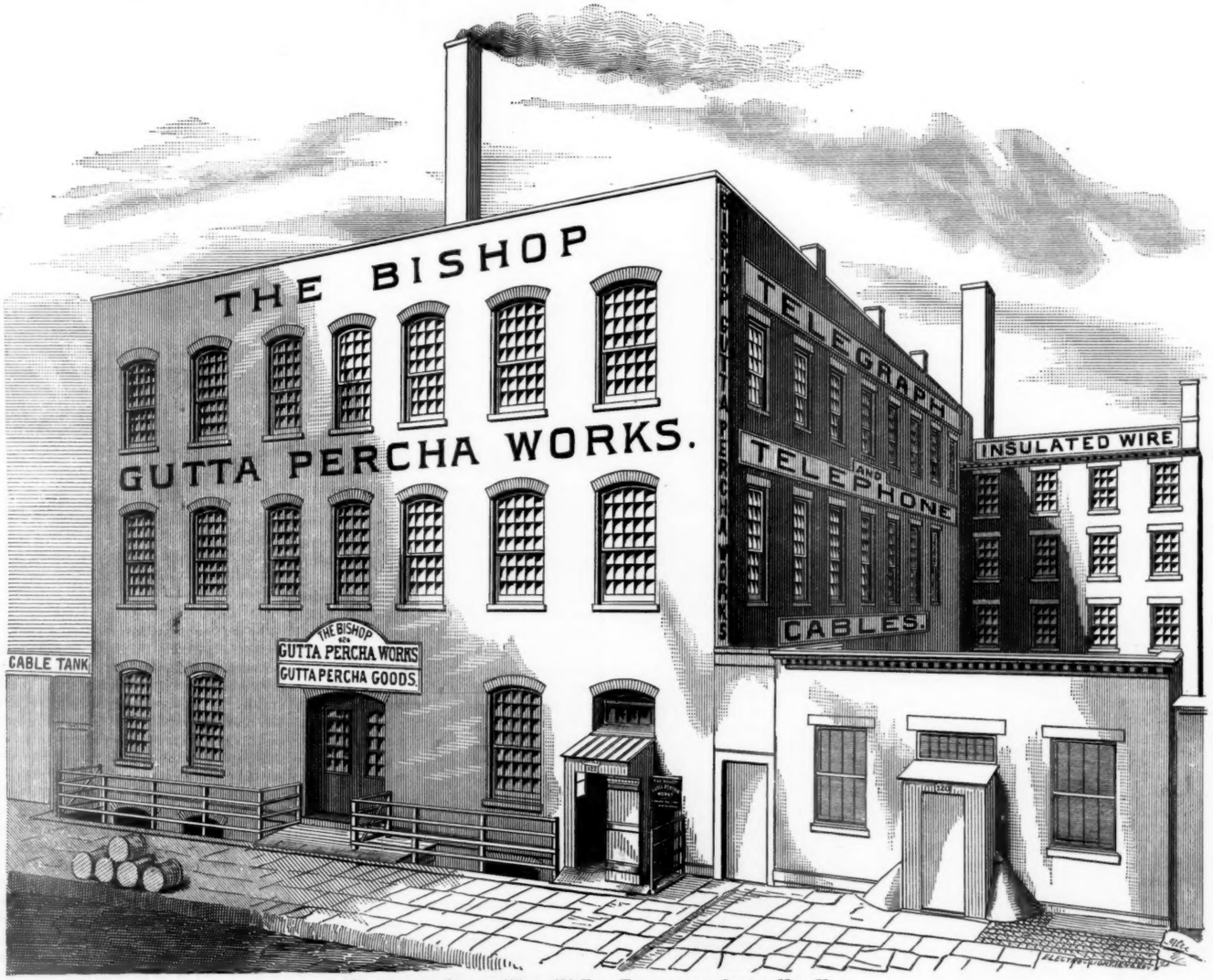
The Bishop Gutta-Percha Works, New York City.

ORIGINAL AND ONLY MANUFACTURERS IN THE UNITED STATES OF GUTTA-PERCHA INSULATED ELECTRIC WIRES AND CABLES.

We take great pleasure in presenting to our readers an illustration showing the factories of the Bishop Gutta-Percha Works, the original manufacturers in the United States of pure gutta-percha insulated wires and cables for telegraphic, telephonic, and electrical purposes, as well as the only establishment manufacturing pure gutta-percha goods of every variety.



FACTORY AND OFFICE, 420 TO 426 EAST TWENTY-FIFTH STREET, NEW YORK.

Gutta-percha is the Malayan term given to the concrete juice of a tree belonging to the natural order *sapotaceo*, indigenous to the islands of the Indian Archipelago, but more especially to the Malayan Peninsula, Borneo, Ceylon, and their neighborhoods.

This valuable substance, being of a milky juice or edible sap, circulates between the bark and wood in veins whose course is distinctly marked by black longitudinal lines, and, when collected, consolidates quickly, forming a compact mass in hardness somewhat resembling wood, but of so spongy a formation as to be of little use as timber.

It was really discovered at Singapore in 1822, and first imported into England as an article of commerce in 1842. It was first introduced into America by Samuel T. Armstrong in the earlier part of 1847, for the purpose of insulating submarine telegraph wires to be laid across the Hudson River for the Magnetic Telegraph Company, which was successfully accomplished in 1848, and adopted as a substitute for the iron wire that was suspended over the river by means of poles. The earliest application for telegraphic purposes was in Europe in the year 1846, when several hundred miles of insulated wire were laid in Prussia.

The insulating properties of gutta percha, and its valuable qualities, as a perfectly practicable non-conductor of electricity, became known almost simultaneously with the discovery of the electric current. In the past thirty-eight (38) years gutta-percha has maintained its superiority over all so called insulating materials and compounds for the insulation of submarine cables, subterranean conductors, office wires, and ærial lines where a perfect and complete insulation is requisite; and is to-day acknowledged by eminent electricians and practical telegraphists, both in this country and Europe, to be the cheapest and as perfect and reliable insulation for telegraphic wires and cables, and by many is highly recommended as being superior to all others on account of its excellence as an insulation and durability as an insulator.

Its chemical and mechanical properties are entirely opposite those of India rubber, being a fibrous substance, tenacious, without elasticity or much flexibility. It has an exceedingly fine grain, and is of an oily composition, which property makes it perfectly impervious to water and other liquids, absorbing but one per cent. to four of any rubber compound. It is thoroughly insured against the action of acids and alkalies, as the most powerful acetic, hydrofluoric or muriatic acids and chlorine have no perceptible effect upon its

structure or capabilities. It is completely unaffected by cold water, disregards frost, and displays remarkable acoustic qualities; in fact, is a substance that improves by submersion in water, and is apparently indestructible.

The prevalent idea among those who are unfamiliar with the applications and uses of either gutta-percha or India rubber that they are identical, is incorrect to a certain extent. The former possesses an adaptability for specific purposes that the latter does not. Gutta-percha possesses superior powers of resistance to the influences of moisture, the action of acids and alkalies, which render it valuable and indispensable in the manufacture of various articles for all chemical purposes, etc., and through its insensibility to the influences of electricity, therefore, becomes pre-eminently adapted for the perfect insulation of electrical conductors.

The Bishop Gutta-Percha Works, from the earliest introduction in this country of gutta-percha, have been and are exclusively the only manufacturers of this article. These works have occupied since 1862 the premises Nos. 420, 422, 424 and 426 East Twenty-fifth Street, in the City of New York, where are the office and salesroom, having an entrance directly from the street. The main factory was built expressly for the manufacture of telegraph cables and wires, and is perfectly adapted for that purpose, being thoroughly equipped with special machinery of elaborate and costly description, most of which is the invention of Mr. W. W. Marks, superintendent of the works.

Mr. Marks became connected with the business from the inception of the enterprise, and has been the sole manager since the year 1872. Thoroughly reliable and experienced, being entirely master of every detail, under his immediate direction this complete establishment has been enabled to produce the finest class of work with greatest precision, perfection, and dispatch. He has, during a number of years, devoted much time in the construction and perfection of especial machinery, which has greatly improved the process for the manufacturing of insulated electrical wires with gutta-percha, and also has by experimenting produced goods which are unsurpassed and seldom equaled by any of foreign make, thereby largely increasing the business.

The principal department of the establishment is the manufacture of telegraph cables and insulated wires of every description.

All electrical cables manufactured by these works contain conductors consisting of a solid copper wire or a strand of any number of copper wires laid up spirally, the conductivity of the copper being guaranteed to be at least 95 per cent. of that of pure copper.

SECTIONAL VIEW SUBMARINE CABLE.

The copper wire used is not tinned previous to being insulated with gutta-percha.

This custom of tinning the copper conductor becomes necessary when any of the inferior insulating compounds or mixtures are used, and is employed in the useless attempt to obviate the complete destruction of not only the wires, but oftimes the insulating material, caused by the sulphur employed in the curing process coming in contact with the chemical action which takes place.

In a paper by Willoughby Smith, Vice-President of the Society of Telegraph Engineers and of Electricians, read before that body at the Electrical Exhibition in Paris, the following appears:

"Thirty-three years' experience has taught us that neither the electrical nor mechanical qualities of either copper or gutta-percha deteriorate by long working or submersion, but retain all their original qualities; consequently, the best form of a submarine telegraph cable will be that in which these conditions are fulfilled. Each copper conductor is insulated with three or more coatings of pure gutta percha, thus insuring a perfect insulation, which adheres firmly to the wire, being then termed a "core."

Notwithstanding the fact that during the covering of the several coatings upon the copper wires the insulation is subjected to a fine galvanometer test, it is immediately upon completion immersed for at least two days in huge testing tanks, at the expiration of which time are again carefully and thoroughly tested by Mr. J. H. Vanderhoef, an experienced electrician, who has been connected with the establishment for over thirty-two years.

The "cores" are then stranded when more than one is used, the interstices caused in the laying up being filled with soft hemp yarn. The bedding consists of three or more spiral layers of the finest quality hempen yarn, laid on in reverse or opposite directions to one another.

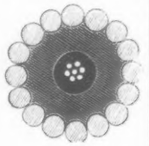
The armor or iron covering consists of a number of galvanized iron wires, laid spirally around the hemp serving, or the bedding, the quality of wire used being known as "B B," thus forming an almost impenetrable armor. Every cable is carefully tested at the works before delivery, and a copy of the result of such test, showing the electrical condition of the cable, is furnished, if required.

When so ordered, cables are wound upon serviceable reels ready for transportation, and from which they can be easily laid.

Submarine cables may be stored in the huge tanks adjoining the building, built specially for that purpose, or tested in the tank, which is supplied with all the necessary requirements and apparatuses.

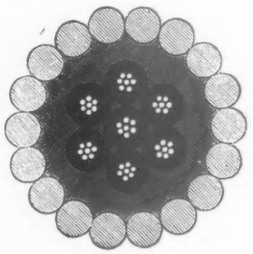
This establishment manufacture fifty regular sizes of cables ranging from those having but one conductor, like samples Nos. 11 and 16,

11.



16.

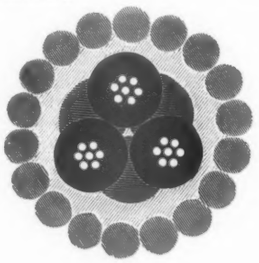
to those containing ten conductors, and so perfectly are they constructed that there has never yet been a complaint made by any company against one cable of the many delivered and laid.



73.

No. 73 is an end view of a seven-conductor gutta-percha insulated submarine cable, designated as the North River pattern, and is one of strength and compactness; and this, together with the use of the very best materials and workmanship, insures durability and reliability. Of this style of submarine cable there has been already delivered and laid, for the Baltimore and Ohio Telegraph Company, over six miles, on account: two cables each over one mile crossing the North River; two shipped to South Amboy; one sent to Camden; and one, 6,300 feet, laid across the Narrows, being substituted for inferior cables recently purchased by the Baltimore and Ohio Telegraph Company, and by them condemned after they had been laid but a short time.

The most convincing proof these works have of the superiority of the gutta percha insulated cables over the cheap and inferior qualities of cables offered by imitators, is the fact that they have continuously furnished for over thirty-five years, and still continue to supply, electrical cables and insulated wires to every telegraph company in the United States and Canada, as well as shipping their productions in large quantities for use in Mexico, Ecuador, Chili, British Columbia, West Indies and elsewhere.



35.

No. 35 is an end view of the largest three-conductor telegraph cable ever manufactured. Cables of this description were successfully laid across the North River and Western rivers for the Postal Telegraph Company, and by them greatly recommended for their excellent qualities.

Cables containing six conductors were also laid by this establishment for the above-named company. They were composed of twisted conductors, insulated with gutta percha of the size represented in cut No 35, having, in place of the yarn used as laterals, three cores, each consisting of a No. 14 copper wire, insulated to .162, with gutta percha run into the interstices, thus forming a substantial cable.

In 1862 these works furnished the Government in sixteen days thirty-three miles of gutta-percha submarine cable for the channel crossing at Fortress Monroe, and at another time sixteen miles was furnished in five days to replace a cable lost off Cape Henry during a severe gale.

The shore end of this cable was landed at Cape Charles in time to afford the transmission of the splendid victory of the Monitor in the disabling of the Merrimac.

As an insulation for under-ground wires and cables, it is only necessary to refer to the extensive and exclusive use in Germany and other European countries, to convince the telegraphic fraternity of its superior qualities.

A sample of a cable manufactured in 1849, and laid by Mr. Marks, for the Merchants' Telegraph Company, as a part of the New York and Boston line, can be seen at the office, which was dug up on May 22, 1880, by some laborers at work near High Bridge, after it had been buried for over thirty-one years. It is an iron wire, insulated with gutta-percha; and, from appearances, one would not suppose it had been so long interred.

Excellent facilities are offered by this establishment for furnishing in the quickest time every style and any length of an aerial and subterranean cable with as many gutta-percha insulated conductors as may be desired, they having furnished for under ground purposes cables containing from 1 to 150 conducting wires.

The regular style of cable is first stranded, then wrapped with two or more spiral coverings of hemp banding or tape, saturated with waterproof compound. Cables of this description have been in constant use in Europe for more than 30 years, and in the United States for the past 25 years, and have given entire satisfaction.

These works furnished the largest under-ground cable now in use. It contained 60 conductors, each consisting of a .067 copper wire insulated to .203, stranded and wrapped with several coverings of extra quality hemp, and was laid in the streets of New York City.

This Company patented in 1855, and are therefore the originators of a process, and the inventors of an ingenious and powerful apparatus, requiring an immense pressure, for the covering of core with a continuous coating of lead without joint or break.

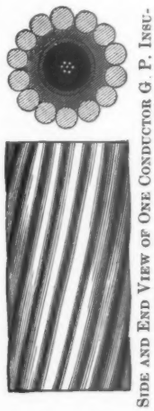
This wire being greatly used and preferred for running in brick walls and damp places, laying under ground, in connecting outhouses with other buildings, for burglar alarm telegraphs, for crossing brooks and rivulets, and for all electrical purposes requiring extra protection and safety, and where an iron armored cable would be too heavy and expensive.

Conducting wires, whether insulated with gutta-percha or cotton braid covering, and then encased in a lead covering, are armored with galvanized iron wires in the same manner as are submarine telegraph and telephone cables.

A great many anti-induction cables have been furnished for telephonic use, including two of ten conducting wires laid across the North River, in 1879, for the Metropolitan Telephone Company.

They also furnished, in 1876, on the order of General John Newton, over 321,000 feet of gutta-percha insulated leading and connecting wires, which were exclusively the only insulated wires used up at the "blowing up" of Hell Gate, in the East River, New York City. The success which attended that gigantic undertaking was mainly due to the excellent quality of the insulated wires.

Gutta-percha insulated torpedo cables, as made by these works, are highly recommend-



SIDE AND END VIEW OF ONE CONDUCTOR G. P. INSULATED CABLE. SUB-MARINE.

ed by the European Governments; have been successfully used by the Peruvian and Chilian Governments, South America, with increasing confidence in their superiority; considered by the Russian Imperial Navy as being the only substantial and flexible torpedo cable, and after many months' experimenting at Newport by the United States adopted as the only reliable ones made.

Besides gutta-percha insulation this establishment insulate wires with Balata and Marks' Compound. The latter compound is the invention of Superintendent Marks, and is a very compact and tenacious covering, and will endure rough handling; being perfectly pliable, it does not crack, and rapidly improves with age, and is greatly preferred for aerial use.

After many years' continued use it has been adopted by all the telegraph companies, and is now exclusively used as a wire for battery connections, as the action of acids has no perceptible effect upon it.

It is manufactured in two sizes, of 14 and 17 inches, and delivered in packages containing 1,000 pieces each.

Balata is another compound whose electrical properties were first discovered and patented by these works. It is an insulation considered equal, in some respects, to gutta-percha and Marks' Compounds, and far supe-

rior in every respect to rubber, or any of its compositions.

It is covered upon the finest sizes made of copper wire, and is greatly warranted, its insulating qualities then being preferred to the cotton or silk coverings.

Copper conductors, insulated with any of the foregoing named insulations, will always be found in the exact center, and are claimed to be unequaled for purity and unexcelled for conductivity, and for use in office, aerial, underground, and battery connections are unapproachable.

These works, in the year 1858, first manufactured a compressed electric cordage, which was patented in the following year, and which is now commonly called braided office wire. It was furnished to meet a demand of the telegraph companies for a cotton-covered wire for office use, and a covered wire for out-door purposes.

The former style was designated electric cordage, and the latter, a linen-covered iron wire, of which many miles were furnished Col. Fremont, was called iron pole cordage.

Within the past 17 years, neither time, labor nor expense was spared in experimenting with every known oil, wax, paint, shellac, varnish, Canada balsam, paraffine, glue, sizing, and all the so-called patent varnishes, compounds, and combinations of many of the same, and others that have since come into existence with the firm determination that cost what it might, they would furnish nothing but the very best that could be produced.

How far these works have succeeded in the past the increasing demand for their very popular goods from all parts of the Union leaves no room for conjecture.

Since they first began the manufacture of cotton-covered wires for electrical purposes, now over a quarter of a century ago, they have continuously increased the facilities by improved machinery, until now they produce the finest and cheapest superior finished braided office wire, annunciator, call-bell and burglar alarm wires, electric gas lighting wires and cables, silk and cotton and fibre covered magnet wires, German silver resistance wires, medical and switch cords, telephone flexible cords, and every description and variety of insulated wires and cables for all electrical purposes.

In addition to the electrical manufactures, this complete and model establishment manufacture a variety of articles from gutta-percha, which are indispensable in the battery room, laboratories, and other uses. Vessels of every description for acids, chemicals, ink, vinegar, electro-plating, &c.

Pipe for ale, beer, soda-water, inks and for conducting other fluids. Gutta percha pipe was first made and laid in the East river in the year 1848, as a conduit between this city and Blackwell's Island. In sheets for cable splicing, electrotyping, horse-shoe stuffing, surgical and dental purposes, and many other uses and purposes too numerous to mention.

In the manufactories of the Bishop Gutta-Percha Works, there are employed only intelligent and experienced workmen, six of whom have continuously worked in various departments over 37 years, and the remainder with a few exceptions, some time over fifteen to thirty years.

These works in the year 1863 were the first to adopt the eight hour system of labor in the United States; and after a prolonged trial of nearly 21 years, we are satisfied that it is most advantageous to both parties. At times—as during the rebellion, to meet an emergent demand of the Government, or to execute work urgently required by telegraph companies—they have been obliged to run day and night, and in such cases employ relays of workmen, that no one labor more than is beneficial.

In conclusion we would state for the information of those who may have business with the Bishop Gutta-Percha Works,—of which Samuel Boardman, Esq., is general agent—that the office is at the factory, No. 422 E. 25th street, where may always be found from 8 o'clock, A. M., to 4.45 P. M., the reliable business manager, Mr. W. W. Marks, and to whom all communications should be addressed.

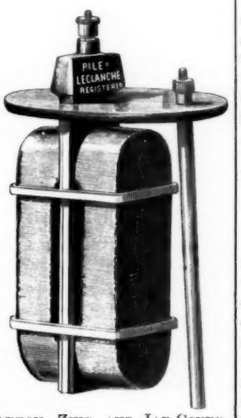
All parties who wish to investigate electrical cables of every description, insulated wires for all purposes, and other articles manufactured from gutta-percha, especially those seeking new applications and uses for this valuable product, will be cordially welcomed, and will find their purposes most ably assisted of accomplishment by the employment of the facilities of these works and the experience of its manager.

A New Form of Prism Battery.

The introduction of the telephone brought a demand for an efficient working battery for open circuit work. To a very great extent the demand in question was met at once by a form of battery designed and patented by the Leclanche Battery Company of New York. Almost all telephone companies are familiar with the style first made, many thousands of which are doing good service to-day. The management of the Leclanche Company have recently made some improvements, and are now introducing a new form of jar and cover for the well-known prism battery, an illustration of which we give herewith. The cover rests upon a shoulder inside of the jar, which is oval in shape, the rim of the jar above the cover being concave in shape. The cover, when in place, closes the jar sufficiently tight for ordinary purposes; but, if desired, it may be hermetically sealed by pouring on the cover melted wax, which will spread over the cover, run into the concavity of the rim, and be held firmly in place, thereby effectually sealing the jar. Any kind of wax may be used for the purpose, but paraffine is preferable on account of the ease with which it can be removed. The cell can be unsealed with an ordinary pocket knife whenever necessary to renew or clean it. The latter process, however, will scarcely be necessary, as the paraffine prevents the salts from climbing up and fouling the cover. A cell thus sealed can be transported on boats, cars, and other vehicles without danger of slopping over the liquid. The adoption of the new jar and cover is a manifest improvement, and will undoubtedly add to the reputation of this famous battery. The jar and cover have both been patented.

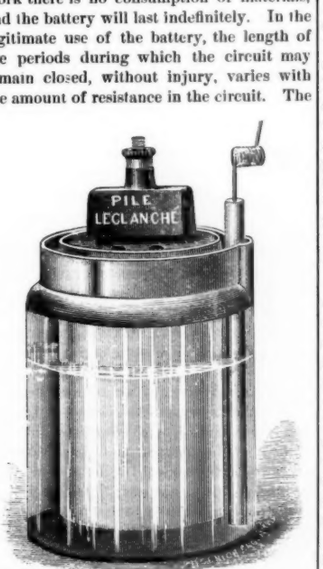
Our readers in the telephone field are for the most part familiar with the Leclanche prism battery, yet a short description of the principal features of it will be of interest to many. The prism battery possesses the unquestionable advantage of dispensing with attention during long periods of service, provided that it be used only for those purposes for which it is suited and for which it was intended. It is an open circuit battery, and is not intended for closed circuit work. By open circuit work is meant that requiring the closing of the circuit temporarily and for short periods only, such as service on telephones, call bells, annunciators, burglar alarms, etc., etc. No internal action takes place in the Leclanche battery unless the circuit is closed, so that when not actually at work there is no consumption of materials, and the battery will last indefinitely. In the legitimate use of the battery, the length of the periods during which the circuit may remain closed, without injury, varies with the amount of resistance in the circuit. The less the resistance, the greater will be the tax on the battery, and the shorter the time required to exhaust the elements; the greater the resistance, the less will be the tax on the battery, and the longer will be its term of service. With a high resistance it may be used for purposes requiring the closing of the circuit for a half hour or more at a time. By closed circuit work is meant that in which the battery is kept continuously in action It is not intended for such work. The idea that whenever the battery fails to work properly sal ammoniac should be added, is an erroneous one. A saturated solution (that is, just as much as the water will take up and dissolve and no more) is the proper quantity to be used; any amount over that will not increase the efficiency of the battery, but will rather be detrimental.

PRISM BATTERY, COMPLETE.
Size of Jar: 4½x3¾ inches; height, 6½ inches.



PRISMS, CARBON, ZINC, AND JAR COVER.

DISQUE POROUS CELL.



DISQUE CELL, COMPLETE.
Size of Jar: diameter, 4½ inches; height, 6 inches.

This company also manufacture the well-known disque cell, so long used by the telephone people. The above cuts represent the Leclanche disque cell, which, until the introduction of the Leclanche prism cell, was one of the best open circuit batteries made, and the one most generally in use both in this country and in Europe. It is still used to some extent, and, as made by the Leclanche Battery Company of the best materials and with care and skill, is an efficient and useful battery.

No internal action takes place in the Leclanche batteries unless the circuit is closed, so that when not actually at work there is no consumption of materials.

The success of the immense business built up by this company is entirely due to the able management of Messrs. Hilborne and Cornelius Roosevelt and Mr. Horatio J. Brewer. The improvements in their batteries have kept pace with the improvements in other apparatus used in the telephone field.

Electric Time Service in New England.

The Rhode Island Telephone and Electric Company, of Providence, R. I., who are well known to our readers as manufacturers of telephone apparatus, have recently introduced at Providence the new system of electric time service. They have in use there, working to the entire satisfaction of their subscribers, about three hundred of the dials under the patents of the Time Telegraph Company, of New York, and have orders a great deal faster than they can put them in. They have one establishment fitted up with a clock and twelve dials, an order from another for a clock and twenty-two dials, and negotiations are pending for fifty other dials to be placed in one manufacturing establishment, while the demand and inquiry is constant from all portions of this city and State. They are the licensees for the New England States, and are in negotiation for the sale of territory for the following places: Worcester, Hartford, Manchester, Lowell, Cambridge, Boston, New Bedford, Fall River, Taunton, Martha's Vineyard, and some smaller places. The system works very satisfactorily indeed, and bids fair to be as popular in another direction, as the telephone system is. The time, by some attention of course, is kept perfectly accurate. The present outlook of the company would indicate an immense future for this business, and a future which will in no way conflict with the Oram system.

No one familiar with the life of the modern man of business can fail to appreciate the importance of having correct time, even to very great exactness. And it is not remarkable that bankers and others who contract time obligations should look with favor upon any system that even promises uniformity of time; or that lawyers having cases set down for a definite hour should wish to be delivered from the disappointment of having a case adjourned, because of a difference in timepieces, which they can neither foresee nor control.

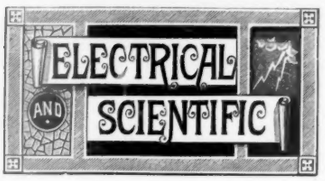
This movement for introducing standard time has, therefore, passed the stage of experiment; it is an accomplished fact; it is a possible thing, and supplies a positive demand.

Everywhere the service has given great satisfaction, there having been absolutely no fault in the synchronizing signals since the opening of the line.

The clocks are handsomely constructed and of rich finish, being thus a great ornament to any office or building.

The officers of the company are: Hon. Henry Howard, President; J. W. Duxbury, General Manager; Chas. T. Howard, Treasurer, and F. H. Gardner, Superintendent.

The New York Time Company feel that the success of the business in New England under this management is already assured.



* * The international exhibition of motors and implements for the small industries to be opened at Vienna on July 24, will close on Oct. 12.

* * The meeting of the International Congress for the Determination of Electrical Units recommences its sittings during the present month.

* * The next meeting of the American Society of Mechanical Engineers will be held in Pittsburgh, the session opening on Tuesday, May 20, 1884.

* * The Electric Railway at Brighton, England, was opened, and has been running successfully since the 8th ult. The speed is limited to eight miles per hour, but a much higher rate can be attained.

* * The annual literary prize of $5,000, instituted by the King of the Belgians, will for 1885 be granted to the author of the best work on the means of popularizing the study of geography, and developing it in the different educational establishments.

* * Mr. W. H. Massey, of the Society of Telegraph Engineers, London, has strongly urged the introduction of a small engine and dynamo-electric machine on each locomotive, in order to supply incandescent lamps, by means of which, he maintains, railroad carriages can be lighted better and cheaper than by gas jets.

* * The Glasgow *Medical Journal* describes an electro-magnet having a power to raise upon its point a weight equal to two ounces. It has been used successfully in cases where workmen in iron and steel have been severely wounded by flying chips, and the writer says that such an instrument must henceforth become an essential part of the apparatus of ophthalmic surgery.

* * Platinum heated in a forge fire in contact with charcoal becomes fusible. Boussingault has shown that this is due to the formation of a silicide of platinum by means of the reduction of the silica of the carbon by the metal. Two German savants have produced the same phenomenon by heating to white heat a slip of platinum in the center of a thick layer of lamp-black free from silica.

* * The plan of using the enormous water-power of the Alps for working electric railways in Switzerland appears to have taken a definite shape, the idea being to connect the towns of St. Moritz and Pontresnia by an electric railway four and three-fourths miles long, the motive power to be supplied by the mountain streams, the line, in case the plan proves a success, to be extended a considerable distance.

* * A new variety of sulphur has been obtained by M. Gernez in the form of very long prisms of a pearly texture by rubbing the sides of a test-tube containing the surfused sulphur with the end of a platinum wire or glass rod. When these crystals are introduced into surfused sulphur they give rise to a growth of similar crystals throughout the mass, and the formation is much more rapid than that of either of the previously known forms.

* * A London newspaper says it is probable that 1,000 members and associates may cross the Atlantic to attend the Montreal meeting of the British Association for the Advancement of Science, in August. From Montreal the Canadian and visiting scientists visit Philadelphia where they will be the guests of the American Association. The total number of scientist guests, it is anticipated, will be about 2,000. They will be present at the International Electrical Exposition.

* * Prof. T. A. Edison, the inventor, was the guest of the Mechanics' Association and the Natural History Society of Worcester, Mass., at a reception and collation at the Bay State House on the evening of May 1st. Previous to the reception he conducted the experiments at a lecture on applied electricity, in Mechanics' Hall, under the auspices of the two societies. Various systems of electric lighting were shown, as were the loud-talking telephone, the microphone, the phonograph, and the electric motor, as applied to railways, sewing machines, and lathes. The hall was crowded by a paying audience of 2,000 persons. The exhibition will be repeated to-morrow night for the benefit of students in the various educational institutions of the city.

* * An interesting communication on the treatment and cure of elephantiasis amongst Arabs by Doctors Moncorvo and Aranjo has been presented to the French Academy of Sciences. It consists in decomposing the tumid swelling of the limbs, known as elephantiasis, by electrolysis, but at the same time the general health of the patient is treated hydropathically, that is, by the cold-water cure, sea-baths, tincture of iodine, iodide of iron, arsenic, and other tonics. These medicines are intended to renovate the constitution, but of themselves will not reduce the tumors. Electropathy, however, applied as soon as possible after the first manifestation, checks, and ultimately cures it. The cure is generally perfect, and takes place at the end of a few days in some cases; but if the elephantiasis is of long standing the cure is also a long process, and must be accompanied by proper medicines. The electrolysis is effected both by continuous and interrupted currents sent through the tumid swelling.

* * At the March sitting of the Electrotechnische Verein, Dr. O. Froelich delivered an address on the electro-technical machines and establishments of the firm of Siemens & Halske. Referring to the present position of electro-chemistry, the lecturer stated that until twenty or thirty years ago great animation reigned in this department; little progress had been made since, which was the more surprising as precisely in late years electrical machines had been perfected in so great a measure. Dr. Froelich then discussed the theoretical law of electro-chemistry, more especially that of Faraday, and expressed his opinion that the results of these laws are of very limited value to practical workers. The new electric machines offered the means to obtain very high effects, but chemists had not yet made a sufficient use of them. The lecturer then gave a description, illustrated by models, of the large electrolytical establishments for mining purposes erected by Siemens & Halske, particularly for the electrolytical refining of copper from ochre, copper from copper ore at Genoa, and the production of magnesium by M. Gratzil at Hanover.

* * In the report of an address, delivered before the Engineers' Association of Liege by Mr. Eric Girard, are given the following details of the programme of the Montifiore Electro-Technological Institute, of which he is one of the professors: The object of the institute is to educate young men to be electrical engineers, and their theoretical education will be accompanied by practical experience and laboratory work, in order to make the students familiar with the practical working of all instruments and apparatus. They will be required to make their own apparatus to a great extent, and, beside their scientific and practical studies, they will be required to study the languages in which books and papers relating to electrical science are printed, and to translate such articles into French. The course for those who devote themselves exclusively to electricity will last only one year; but for those who pursue other studies as well, it will extend to two years. The school now has eighteen pupils, but the liberal policy instituted by M. Montifiore is sure to bring many more, and to greatly aid the development of electrical science.

* * The electric railway between Sachsenhäusen and Offenbach has been completed. The line comprises twelve stations, and has so far been worked with success.

* * The *Bulletin de la Compagnie Internationale des Téléphones* says: "The applications of electricity increase day by day, but good books on the subject are very scarce. Many works have been written and printed, but most of them have the fault of being so scientific; they are evidently intended for members of the institute rather than for practical people. Instead of examining electricity from the standpoint of its practical use, the greater part of these authors seek only to reduce electrical phenomena to equations. Hence it is that we always welcome any work of a practical character."

* * Dr. Aron exhibited, at a recent meeting of the Electrotechnical Society of Berlin, various specimens of vegetable carbon made conductive and incombustible within limits by strong heating *in vacuo*, or in a neutral atmosphere. Heat appears to render carbon first conductive, and then at the highest degrees practically incombustible. Dr. Aron showed incombustible wadding, paper, postcard, and other carbonized specimens. They resist the heat of a Bunsen burner, and even that of a gas blowpipe, so that they might be used for lamp carbons. As high conductivity and incombustibility are characteristic of graphite, carbons prepared in this way may be called artificial graphites, although they do not, under this treatment, assume the crystalline structure of natural graphite. The electric current is, of course, very suitable for their preparation. Under very strong heat soot becomes a better conductor than graphite, and might thus replace the latter in electro-metallurgical operations. It further results from Dr. Aron's experiments that if the amount of hydrogen in a graphite really determines its combustibility, as is often asserted, the influence can only be due to the amount of combined hydrogen, as carbons did not become more inflammable by being rendered incandescent in a hydrogen atmosphere.

* * M. A. Callaud has communicated to the French Academy of Sciences a new modification of the cable lightning conductors, such as are made by him for the French Ministry of War. Hitherto the conductors have terminated in holes filled up with coke, but this arrangement, which is good enough if the cable is intact, is defective when oxidation attacks the copper. Doubtless the copper, coke, and moisture form a voltaic combination resulting in corrosion of the metal, and hence the coke, packing of a copper lightning rod "earth," though recommended by a recent learned commission on the subject, is not quite satisfactory. M. Callaud adopts the following plan: Each wire of the cable is surrounded with hemp impregnated with white lead, or with minium. These served wires are wound or cabled round a central naked copper bore or wire, which has no need to be protected. The whole cable is then wound with linen or tape impregnated with white lead or minium. This makes a protective covering for it. M. Callaud's plan is no doubt a good protective of the conductor itself from oxidation, but we fail to see how the local voltaic action is to be prevented between it and the coke, unless the minium, being a conductor, serves to shield the metal from electric corrosion while allowing the conducting contact with the carbon or coke to be established.

Electrical Development and Manufacturing Company.

We have received the new prospectus of the above named company, which has been in a measure reorganized by reducing the capital stock one-half, and by the election of a new board of directors. The laboratory, factory and office of the company is to be in the fine building 197–205 Devonshire st., Boston, the lower stories of which are occupied by the American Electric and Illuminating Company, and the Merchants Electric Light and Power Company. Power will be furnished by the latter by means of motors, and a fully equipped laboratory and workshop will be established.

The following extracts from the prospectus in hand show the work which it is the intention of the company to undertake:

"The commercial development of electrical inventions, although in its infancy, already occupies the attention of many of the ablest minds in the scientific world. Numerous systems of electric telegraphs, telephones, arc and incandescent lights, signals, messenger call boxes, batteries, insulators, alarms for fire and burglar purposes, call bells, annunciators, electric gas lighters, medical appliances, etc., require the construction and repair of expensive and accurate mechanism at an annual expenditure of several million dollars.

"The constant increasing demand for electrical machinery appliances, and construction supplies can only be appreciated by those who have occasion to examine the hundreds of new electrical devices which are patented each year, and who watch the increased volume of production of the established forms of electrical appliances which are almost imperceptibly coming into general use. This is the 'Electrical Age,' and the use of electricity in the various departments of business and domestic economy is growing to immense proportions.

"The demand for electrical mechanism and supplies up to within a few years was limited. They were manufactured in small quantities, at the shop of some able mechanic, who had a few workmen to assist him; but now a completely equipped factory, with an expensive plant in machinery and tools, and scores of skilled electricians and mechanics, is required to handle economically and rapidly the vast and constantly increasing demand for the numerous classes of standard electrical instruments and supplies, not to mention the special applications and the experimental work ordered by inventors. The same process of growth that occurred in the manufacture of cloth from domestic weaving to large steam and water power mills, has now come about in the manufacture of electric mechanism, and with it proportionally increased profits to the producer, as well as improved results to the consumer. This business is now as stable as the growing of wheat or the manufacture of boots and shoes.

"In addition to this large and important line of operations, this company proposes to add to its regular manufactory and supply trade a special department for the development of all electrical inventions, whereby inventors may be given the necessary facilities and assistance to enable them to perfect their inventions and to reap a fair reward for their labors in case practical success results.

"The hundreds of inventors who are engaged in the study of electrical appliances cannot find a single establishment in America where they can be provided with the opportunity of carrying on their studies, experiments, and development under confidential conditions, with all the facilities which are secured by a complete electrical consulting library, laboratory, and the assistance of skilled electricians, mechanicians and tools.

"To supply this long-felt need of inventors and to undertake the manufacture and commercial development of perfected and valuable inventions is the pecular and special work of this company. The great importance of this development department will at once become apparent, and out of the numerous inventions brought to the attention of the company's experts it should be possible to select valuable inventions which it would pay the company to develop, patent, and manufacture, and out of which large profits would be realized,"

The following is a list of the officers and directors:

President, Edward H. Goff; Vice-President, Loren N. Downs; Secretary and Treasurer, Edward I. Sears; General Superintendent, Geo. F. Millikin.

Directors—Loren N. Downs, General Manager New England Telephone and Telegraph Company, Boston; Silas Gurney, President Merchants' Electric Light and Power Company, Boston; Parker C. Chandler, President Drawbaugh Telephone and Telegraph Company, Boston; Edward H. Goff, President American Electric and Illuminating Co., Boston; A. R. Brewer, Secretary Western Union Telegraph Company, New York; D. J. Hern, Superintendent Mutual Union Telegraph Company, Boston; E. A. Leslie, Superintendent Baltimore and Ohio Telegraph Company, New York; William H. Baker, Secretary and Treasurer Brooklyn District Telegraph Company, Brooklyn, N. Y.; H. E. Irvine, Manager Royal Electric Company, Montreal.

ELECTRIC LIGHT NEWS

—— The new steel cruisers are to have Edison dynamos and lamps, with Armington & Sims engines to supply the necessary power.

—— Messrs. Woodhouse & Rawson claim that their new filament lamps have an efficiency of 30 per cent. or more over those of Swan.

—— The Minister of Public Works has resolved to apply the electric light to railway trains in Italy, but not until careful experiments have been made to determine which is the best system.

—— Brockton, Mass., is in a fair way to be well illuminated electrically. It already has the Edison light in operation, the Jenny arc light is to go in, and now it is said that a Pilson arc-light plant is to be installed there.

—— Mr. William Astor's new steam yacht, which, it is said, will be the finest vessel of the kind ever built, and the first to be constructed of steel in this country, is to have electric bells from all rooms forward, also from the house deck to the pantry and steward's, aft, to be lighted by electricity.

—— The use of small electric lights, worn as jewels, is on the increase for theatrical purposes in England. The ballet in the newly-opened Empire Theatre, in Leicester Square, London, being adorned with them. The batteries are small enough to be carried about the person, producing a sufficient current for about half-an-hour.

—— The illumination of the House of Commons by electricity has proved so satisfactory that the system is to be extended throughout the whole building. Here is a fact from which Congress might take a hint, Inasmuch as the incandescent light is found so desirable in the public buildings in other cities there is no reason why it should not be introduced into the Capitol.

—— The Bank of England is lighted with 150 Swan high-tension incandescent lamps. A horizontal portable engine drives the dynamo-electric machine, of an electromotive force of 120 volts and a current of 60 amperes, which charges a 55-cell Faure-Sellon-Volkmar battery to supply the lamps. An Anderson patent magnetic safety cut-off is introduced, to prevent automatically excess of current.

—— The new Bernier gas engine is said to be especially adapted for electric lighting purposes. It is compact in build, occupies small space, works silently and with great regularity, and is easily started. It requires no foundations, and can be set up without any expensive preparation. The quantity of gas consumed is said not to be excessive, and the expense for lubrication is small. It is at present made in different sizes up to four-horse power.

—— For some time past the Portsmouth, England, Dockyard authorities have had on loan from the Brush Corporation one of their compound wound Victoria dynamos, and have now purchased it, for erecting on board H.M gunboat Dolphin, where it will be employed for running a search light of 25,000 nominal candle power, or for lighting the interior of the ship with 100 20-candle power incandescent lamps. The engine used will be a Brotherhood of the most recent type.

—— To appreciate the advantages of the incandescent light over gas, one needs only to take two consecutive trips on Long Island Sound—one on the Bristol, the other on the Pilgrim. The light on the former is thin, dim and uncertain, while the incandescents on the Pilgrim fairly flood the saloons and passage-ways with light. It may be assumed that in the future all new steamboats, which are really intended to be first-class, will inevitably have the incandescent light.

—— The Theater de la Scala, at Milan, is the largest which has, as yet, been lighted by incandescent lamps. Under ordinary circumstances it is illuminated by 2,500 lamps, of which 1,000 are on the stage, which is the largest in the world, 410 in the auditorium and orchestra, 500 in the vestibules, corridors, foyers and boxes, and the rest in the offices, dancing-school, singing-school, painting room, &c.

—— Experiments with a new system of electric lighting, introduced by Messrs. Paget Higgs & Company (Limited), Edinburgh, were recently exhibited in the furniture saloon of Messrs. John Mitchell & Son, Princes street, Edinburgh, whose premises are henceforth to be lighted by means of electric lamps. The installation comprises a set of Plante-Higgs accumulators, a self-regulating dynamo, and an Otto gas engine. The results obtained in the experiments were highly satisfactory, the light produced being perfectly steady.

—— The Sawyer-Man Company, formerly at 11 Pine Street, have moved to their fine new quarters in the magnificent building, just completed for the Mutual Life Insurance Company, fronting Nassau Street, between Liberty and Cedar. They have placed eight large dynamos there, of 200 incandescent lights each, twenty candle-power, and one extra dynamo of 100 lights, making in all 1,700 twenty candle-power lamps. To run the dynamos they have four Westinghouse engines of 55 nominal and 60 horse-power capacity. These are all placed in the sub-cellar, where they rest on the most solid foundations.

—— The aggregation of a large number of families under one roof, as in the new apartment houses in this city, will increase the use of the incandescent light, because in many cases the building contains enough rooms and enough occupants to make it pay handsomely to put in an isolated plant. In large buildings so occupied every possible provision should be made against fire, and, as there is no more fruitful cause of conflagrations than gas, both insurance companies and tenants find it for their interest to insist on the use of electricity as an illuminant. As to the matter of expense, it is very certain that, in a properly-constructed isolated plant, the light can be produced for less than the cost of equal illumination by gas.

—— The Brush corporation have just supplied to Mr. Richard Miller, of Glasgow, two of their Victoria dynamos for lighting the steamer Mexico. The larger of these two machines is intended for running 250 20-candle power lamps at a speed of 550 revolutions per minute. The smaller will be in use for driving the night or "police" circuit when the majority of lamps have been extinguished; for the police circuit about 100 lamps will be in use. Both the dynamos will be driven by engines constructed by Messrs. R. Napier & Sons, of Glasgow. These engines will be of the vertical type, and will drive the dynamos direct by means of an internally geared wheel; this arrangement enables the dynamos and engines to be got into an exceedingly small space, a matter of great importance on board ship, where space is so very limited.

—— The Brush Electric Light Corporation have secured the contracts from the British Admiralty for fitting up the Bacchante, Raleigh and Conqueror. The apparatus to be supplied to these ships consists of search lights and yard-arm lights with engines; Victoria compound wound machines to work the lamps; duplicate machines being supplied in each case. For driving the machines on board the Conqueror and Raleigh, they are supplying the improved type of Brotherhood engine, and on the Bacchante two of Parsons' high-speed engines, manufactured by Messrs. Kitson & Sons, of Leeds. Each dynamo supplied will be capable of maintaining and supplying, at a speed of 400 revolutions per minute, 200 20-candle power incandescent lamps, or a single powerful search light. For the yard-arm lights, reflecting lanterns are provided, each fitted with eight 40-candle power incandescent lamps. The Corporation have lately brought out a converting switch, whereby a dynamo can be made to produce 2 different strengths of current, by means of a cheap and simple device, fitted on to the dynamo shaft. Taking the Case of a No. 7 Brush machine fitted with this switch, this machine may be made to produce a current having an electromotive force of 800 volts, and an intensity of 10 amperes, or of 1,600 volts and 5 amperes, according to requirements. The employment of these has in several cases saved the cost of extra plant, as the machine could be used for charging secondary batteries in the daytime by means of the low-tension current and for running a series of arc lamps by a high-tension current, in the night-time.

—— The subject of lighting the streets of Charleston, S. C , is one that at present engrosses much of the attention of the community. Public opinion seems to be very clear upon the point that the old system of lighting the streets by the "almanac" should be abandoned, and that the streets, whether lighted by gas or electricity, should in future be thoroughly lighted from sunset till sunrise, without regard to the movements of the moon. With this change in view the committee of City Council who are charged with lighting the streets, are testing the rival lights, advertised some days ago for sealed proposals. The Electric Lighting Company propose to furnish 200 arc lights to be located the streets at such points as may be designated by the city, and to be lit from sunset to sunrise at $40,000 per annum. The Charleston Gaslight Company offered to furnish the 1,400 six-foot burner every night in the year from sunset to sunrise, at a cost of about $60,000, and that separate additional estimates have been put in for lighting the markets and the public buildings. Under the contract of last year the Gas Company have been lighting 1,158 street lamps with three-foot burners—the lamps being "lighted by Miller's almanac"—and all the markets and public institutions for $18,000 per annum.

The Electric Lighthouse at the South Foreland, England.

The experiments as to the relative merits of gas, oil, or electricity as a medium for lighthouses are now being tried at the South Foreland, under the direction of the Trinity House. Three temporary lighthouses have been erected close to St. Margaret's Bay, each about 14 ft. in diameter and 20 ft. high, at a distance of about 150 ft. from each other. In one of these three of Sir James Douglass' improved oil lamps are to be placed ; in the second house a quadriform gas light, similar to that on Galley Head, will be fitted; while the third will contain three superposed electric lights as invented by M. de Meriteus, of Paris. The carbons from which these lights will proceed are of about an inch and a-half in diameter, and will emit the most powerful arc light in the world.

The Street Lights.

Many good reasons why they should be increased:

Because light is better than darkness.

Because the electric lights alone properly light the streets.

Because they afford more protection to life and property than any other lights.

Because enterprising cities all over the world are adopting them, and Montreal cannot afford to be behind.

Because the best citizens and heaviest taxpayers desire their increase

Because the police force desire them as an aid in their work.

Because they save the city more than their cost in the pay to policemen.

Because the thieves, loafers, garroters, and evil-doers desire their discontinuance. And lastly, because they will keep the price of gas down to reasonable figures.—*Canadian Electrical News.*

Making Resistance Coils.

Prof. S. P. Thompson has introduced a new method of making resistance coils which is likely to prove useful in saving time lost in adjusting the coil to its correct final value, though it may require more wire. Our esteemed contemporary, *Engineering* (London), says that the existing method is to cut off a sufficient length of wire to give, say, 2 per cent. more resistance than is required; then double it on itself, cut the wire at the bight, bare it, and solder a piece of copper across the naked ends. By keeping the solder soft while the wire is being tested, this bridge-piece of copper can be shifted until the required resistance is obtained. Professor Thompson's method, which is best adapted for coils under 10 ohms, consists in first cutting off a length of wire and calculating the resistance which, as a shunt to its resistance (R), will give the final resistance (r) which is required. Let the resistance of this shunt be s, then,

$$S = \frac{R\,r}{R - r}.$$

A second length of wire giving appproximately this resistance (S) (say 2 per cent. more) is then cut off, and the ends of it soldered to the ends of the first piece. The joint resistance is equal to the resistance r required. Professor Thompson also employs a new form of "meter bridge" in his measurements. There are two wires, one having several times the resistance of the other; and both are 2 meters long. One or other can be used as desired, and the same sliding contact serves for both. This arrangement makes the bridge far more useful, and widens its range. When Foster's method is used to give very accurate tests, the interchangeable coils are transposed by means of a mercury cup switch, which can be attached to the bridge. By simply shifting four copper connecting pieces in the mercury cups the transposition is effected. We may add that Mr Shaw, of Cambridge, has designed a special key, whereby the same transposition can be effected by turning an axle, which, by a series of cams, makes and breaks the contacts necessary for the purpose.

By way of illustrating the superiority of electricity over more ordinary means for the purpose of lighting rooms in dwelling-houses, Mr. Robert Hammond gave a lecture before a considerable audience in St. James's Hall, London, on the 23d ult., entitled, "The Electric Light in our Homes." The stage was fitted up as a drawing-room, illuminated with incandescent lamps, lighted on several of the various systems now in vogue. From this advantageous standpoint, Mr. Hammond proceeded to show the unhealthy effects of gas-burning, through the consumption of the oxygen in the air, and the giving-off of carbonic acid and carbonic oxide. He then gave practical examples of the simplicity of the working of the incandescent lamp, the light from which is of course entirely free from any deleterious results of combustion. On the question of safety, the lecturer explained that for domestic purposes low tension only would be required. Although a shock from the wire at low tension would not be dangerous, the precaution of protecting the wire would be taken; while too great heat would be guarded against by the introduction of lead safety fuses. By these means the lighting would be rendered perfectly secure. Electric lights, it was shown, could not only be put out singly on a pendant with several lights, but could be readily turned down to a low power. With respect to cost, it was tacitly admitted that until the work of electric lighting of domestic houses can be done on a large scale, as is done by the gas companies, the expense will be but very little greater than that of gas. A small reading lamp in use was fed from an accumulator, but it was left to be inferred that at least a gas-engine would be necessary to work a dynamo of sufficient power to light a fairly well-fitted residence. The lecture was given in a particularly clear and intelligible manner, and was evidently appreciated by the audience.

Telephonic News

⁂ Recognition of the voice in telephone conversation is admitted by the courts.

⁂ The New England Telephone Company have just put in 6,000 feet of Paterson's aerial cable in Boston.

⁂ Mr. Albert O. Morgan is the recently-appointed representative of the American Bell Telephone Company for the State of New York.

⁂ The Central Union Telephone Company has 18,750 subscribers. This is the largest number under the management of one company in the world.

⁂ The Union Telephone Company has delayed the declaration of the customary 1½ per cent. dividend on account of a vacancy in the directory. It will probably be declared in a few days.

⁂ In the course of experiments made last week over the copper circuit between this city and Boston, conversation was easily carried on with the ordinary hand magneto-telephone alone, used both as a receiver and transmitter.

⁂ The American Bell Telephone have warned the subscribers of the Clay Commercial Telephone Company of Philadelphia from using telephones which are said to be an infringement of rights granted to the former company.

⁂ From the "Honolulu Almanac and Directory" for the current year we learn that the little kingdom of the Hawaiian Islands is in a very prosperous condition. Incidentally, it is mentioned that there are two telegraph and four telephone companies at work, and that the telephone has become a necessity in private as well as in business houses.

⁂ We have recently seen samples of English cables made for overhead and underground use in connection with the telephone which are said to give excellent results, but their cost is so great as to make their use in this country out of the question. One of them, carrying only ten wires, an overhead cable, would cost, laid down in New York, duty paid, over $2,100 per mile.

⁂ A French meteorologist has, in the exposed court of his house, two bars of iron planted in the earth, to each of which is fixed a conductor of coated wire, terminated in a telephonic receiver. His practice is to consult the apparatus twice every day, and it never fails, through indications of earth currents, to give notice of the approach of a storm twelve to fifteen hours ahead.

⁂ The Boston Telephone Exchange notifies its subscribers that, owing to the introduction of the multiple switchboard, the numbers from 1 to 6,000 will necessarily be very generally changed. This may cause some little annoyance to subscribers for a time, but the gain in promptness of service which will result from the introduction of the new switchboard will more than compensate for it.

⁂ It is said that Mr. Giltay, of Delft, has discovered that a gloved hand will act as a receiver when it is put in telephonic circuit. He used an Ader microphone, the primary of an induction coil being connected to it and to three Bunsen cells. The secondary of the coil was in circuit with a nine-cell Leclanche battery and the line, the ends of the wire being held in the naked hands of two persons standing in a room some distance away. On whistling or singing near the microphone the sounds were distinctly heard by one of the persons holding the wire line, while the other pressed a gloved hand firmly against his ear. In the case of speech the sounds were too feeble to enable more than a few words to be understood.

⁂ The Consolidated Telephone Construction Company has received a gold medal for its exhibit at Calcutta.

⁂ During the march of the volunteers on Portsmouth, England, in their recent manœuvers, a field telephone was used to maintain communication between the commanding general and the different sub-commands. A single instrument was used to answer both as transmitter and receiver, but it is said that the result was not altogether satisfactory. Probably there would have been less difficulty had a complete metallic circuit been used.

⁂ On Friday night, in Philadelphia, about thirty telephone wires were hurled into the street from the top of the Penn Mutual Life Insurance building on Chestnut street, by the janitor, who cut them by order of President Huey, of the Insurance Company. Twenty-six of the wires belonged to the Baxter Tel phone Company, and four to the Baltimore and Ohio Telegraph Company. No complaint had been previously made. Trouble may ensue.

⁂ The telephone business seems to be growing in favor in the remotest parts of the globe. Our Australian correspondent at Melbourne says that the exchange at that place now numbers 700 subscribers, besides many valuable private lines. The annual rental is $72. The Melbourne Telephone Company is just putting in a new Western electric multiple switchboard to improve the service and accommodate the great increase in new subscribers.

⁂ The special agent of the Tropical Telephone Company has returned from the West Indian exchanges, and confirms the sale of the Trinidad property upon terms heretofore published. The deed has gone forward. He brings a proposition from leading Barbadoes merchants for the purchase of the plant there at a price which will net the Tropical about $15,000 cash, and secure a permanent supply contract for the future. The government of Martinique offers an exclusive concession for that island, and a guarantee of 100 subscribers; the company will start an exchange at St. Pierre. The company expects to have a surplus of $1 per share in the treasury July 1.

⁂ A police inspector at Odessa, whose name, Dobrjisky, deserves, in spite of its dissonance, to be mentioned on account of his cleverness, has discovered a new use for the telephone. One day last week a policeman brought to the station a Jew, having in his possession a quantity of silver believed to be stolen. The silver was in a semi-molten condition, and had none of its original features remaining to assist in its identification. Hence, as the Jew stoutly declared the metal to be his own property, the police inspector was put in a fix, from which all his cross-examination of the presumed thief failed to extricate him. At last a bright idea struck him. He went to the telephone in the adjoining room, and, mentioning to the officials at the police-master's office what had happened, instructed them to utter in solemn tones, on a signal being given, the words, "Itsno Smeliansky, it will be better for thee to confess that thou hast robbed somebody, otherwise thy punishment will inevitably be more severe." Afterwards, summoning the Jew into the room, he pointed to the instrument on the wall, and told him that it really did not matter whether he divulged his crime or not, as the "machine" would do it for him. At this the Jew laughed outright, while the inspector placed a sheet of paper on the table and prepared to take down the confession. When everything was ready, he told the Jew to put the tube to his ear, and decide whether he would confess himself or allow the "machine" to do it for him. Then, giving the signal, he returned to the table, when a second or two later he had the satisfaction of seeing the Jew's face turn deadly pale at hearing the solemn advice mysteriously conveyed to him by the "machine," and of noting down directly afterwards a penitent confession from the thief's own lips.

To Memory Dear.

A notice came from the Telephone Exchange to-day announcing that the office was in arrears to the N. W. Division of the Erie Telegraph and Telephone Company to the amount of $5.50, and if not paid on or before April 25th, the instrument would be taken out. This is all right, of course, but the mandate of the telephone company revives some memories that are at once pathetic and pugilistic. We have a great notion not to pay this $5.50, just for the purpose of seeing the hard-hearted minion of the Tel. come down and unscrew the instrument, that has caused so many heart pangs, from the wall. The sight of that dear old transmitter being torn from its familiar resting place near the waste-basket would fill the office with a palsied grief that no language can adequately describe. The tender memories that linger e'en now in association with yon microphone are so endearing that we hesitate to mention them in the same breath with carnal subjects. Many a fond hour have we glued our waiting ear to that beloved thing-umbob and torn it away through sheer force of habit, after being told that some one was trying to mash the new telephone girl on our line. Many a sad and yet joyous moment have we stood on tiptoe waiting for a reply from the shores of Minnetonka's blue waters only to be informed that there was a man, from the dog pound in South Minneapolis, sitting up on our wire trying to make a connection with an east side soap factory. No, we will pay this $5.50 rather than submit to the harrowing sight of the dear old ear-breaker being torn from us. The sight of the d. o. e. b. being yanked from the spot where so many dulcet hours have yielded to the inroads of time would shake our faith in the equity of things supernal. If the cruel despoiler of our wall decorations could insinuate his vicious anatomy into the sanctum some dark night when dull care had driven the office into a neighboring beer saloon, and juggle the instrument out the back way under cover of the darkness, it would be a mercy stroke that would save the office a thousand burstings of those chords which reflect the sentiment of a pent up—"Well, you don't get it!" so there, you devilish devil! take the instrument out!—*Minneapolis Gazette.*

Statistics of the New England Telephone Company's Exchange Subscribers.

We noted, in our edition of last week, that the New England Telephone and Telegraph Company increased its subscribers during the month of March by 185.

This company has telephones in 472 cities and towns of New England, and has in operation 109 telephone exchanges, managed by 24 superintendents, and divided into 24 divisions. The larger cities and towns have subscribers as follows:

Adams	66	Malden	78
Athol	94	Manchester, N. H.	408
Auburn	77	Marlborough, Mass.	81
Augusta	92	Medford	63
Ayer	35	Milford	55
Bangor	219	Milford, N. H.	10
Bath	83	Milton, Mass.	43
Bellows Falls	63	Nashua, N. H.	163
Bethlehem and Littleton	23	Natick, Mass.	38
Biddeford	43	Newburyport	129
Boothbay	12	Newport, N. H.	35
Boston	2,386	Newton, Mass.	155
Brookline	126	North Adams	128
Burlington	202	Northampton	112
Calais, Me.	24	Orange	15
Cambridge	228	Palmer	38
Canton	33	Pittsfield	270
Charlestown	149	Portland, Me.	727
Chelsea	115	Portsmouth, N. H.	82
Claremont	44	Quincy	42
Clinton	77	Rockland, Me.	50
Concord, Mass.	14	Rutland, Vt.	134
Concord, N. H.	210	Saco, Me.	21
Dorchester, Mass.	79	Salem, Mass	320
Dover, N. H.	94	Skowhegan, Me.	31
East Boston	69	Somerville, Mass.	124
Fitchburg, Mass.	229	Southbridge	49
Gardiner, Me.	55	South Framingham	54
Gardner, Mass.	78	Spencer	48
Gloucester	186	Springfield	588
Greenfield	83	St. Albans, Vt.	61
Haverhill	285	St. Johnsbury, Vt.	64
Holyoke	326	Waltham, Mass.	96
Hyde Park	44	Watertown	34
Jamaica Plain	104	Waterville, Me.	37
Keene, N. H.	197	Westfield, Mass.	57
Lawrence, Mass.	297	Woburn	45
Lebanon, N. H.	37	Worcester	784
Leominster, Mass.	56	Agency subscribers	2,220
Lewiston, Me.	186	Balance div'd among the smaller towns	2,122
Lowell	950		
Lynn	501	Total	17,320

Fire Insurance Companies and the Telephone.

A noteworthy suggestion is made in the following: "As telephonic communication with a fire station lessens the risk of a small fire becoming a greater, it is evident that insurance companies are interested in no small degree with such means of communication. It would, undoubtedly, be to their advantage to encourage the use of the telephone among their clients. This encouragement might be given if insurance companies made a distinction between those of their friends who are able to communicate directly with the fire stations, and those who have not the means of so doing. In the former case, the risk of a serious fire being less, a reduced premium ought to be required."

The New England Telegraph and Telephone Company.

At the annual meeting of this company, held in this city, on Monday, May 5th, the following statements were presented by the treasurer, Mr. Wm. R. Driver:

EARNINGS.

Agency	$ 14 283 95
Exchange	344,421 60
Extra Territorial	28,792 45
Messenger	485 47
Miscellaneous	7,625 35
Private Line	7,217 65
Telegraph Commissions	660 03
Toll Line	8,976 74
	$412,463 24

EXPENSES.

Damage and Compensation	$ 5,861 90
Expense of Organization	411 99
Expense of Teams	1,224 76
Freight and Express	1,049 59
General Expense	15,691 87
Insurance	430 43
Instrument Rental	115,400 28
Interest	537 50
Operating Expense	76,775 75
Rebate (chiefly due to fire in Jan.)	2,205 73
Postage, Printing, and Stationery	5,065 46
Reconstruction	4,174 34
Repairs and Maintenance	37,810 28
Rents	8,728 66
Signal Bell Rentals	219 37
	$275,587 91
Net Earnings	$136,875 33
Dividend paid January 25, 1884	$73,395 00

ASSETS.

Licenses	$4,268,000 00
Plant	5,871,063 41
Unissued and Treas'y Stock	1,836,400 00
New Construction	66,393 98
Bells, Material and Supplies	61,699 56
Accounts Receivable	77,699 17
Cash	16,819 55
	$12,198,075 67

LIABILITIES.

Capital Stock	$12,000,000 00
Bills and Accs. Payable	100,922 71
Advance Rental Account	33,487 63
Unpaid Dividends	185 00
Income Acct.	63,480 33
	$12,198,075 67
Net gain of Subscribers for 6 months	1,293

The following named gentlemen were chosen directors for the ensuing year: Theo. N. Vail, Wm H. Forbes, Wm. A. Ingham, Chas. P. Bowditch, Alexander Cochrane, Chas. J. Glidden, John E. Hudson, Frederick Ayer, Stephen Salisbury, Jr.

TELEGRAPHIC

.... The American District Telegraph has just been introduced into use at Savannah, Ga.

.... A length of about 400 miles of brass-ribboned cable has recently been inserted in the original Java-Australian line from Port Darwin to the edge of the Tabul Bank, where the teredo has been found very troublesome.

.... Mr. C. S. H. Small, long connected with the Gold and Stock Tel. Company, resigned his position with them of assistant superintendent, and accepted the office of superintendent of the Commercial Telegram Company, but has since returned to the service of the former Company again.

.... The associated Atlantic cable companies will pass free of charge the social messages of the distinguished delegates attending the meeting of the British Association for the Advancement of Science, to be held in Montreal during the coming summer.

.... The value of telegraph wire and apparatus exported from the United Kingdom in March was £223,601 against £159,529 in 1883, and £384,271 in 1882, and for the three months ended 31st March £555,624, against £478,434 in 1883 and £454,861 in 1882, thus showing a considerable increase for the three months.

.... The Bankers and Merchants' Telegraph Company are having put down in the streets of Chicago two and four-inch pipes, for the reception of some five miles of underground cable. Madison Street and Fifth Avenue are at present all torn up for this purpose, and the work is being prosecuted with vigor.

.... An Englishman was in conversation recently with a conservative Boer of the Transvaal. The old man objected to modern improvements very strongly. "Then you would not even have a telegraph?" said the Englishman. "No," said the Boer; "what's the use of a telegraph? If the news is good, it will keep; if it's bad, it had better not come at all, let alone coming in such a hurry."

.... A report has been communicated to the Academy of Sciences, Paris, by the French Minister of the Postal and Telegraph Department, on the thunder storms which visited France during the first six months of last year. From the full and detailed tables it is learned that in all there were nine persons and seventy-eight animals killed, and about fifty persons and seven animals injured by lightning.

.... The case of the Western Telegraph Company against William G. Jones, assistant superintendent of the Baltimore and Ohio Telegraph Company, and others, for forcible entry, came up in Philadelphia last Saturday, and the defendants were discharged. This case grew out of the forcible possession, on March 1, by the Baltimore and Ohio Telegraph Company, of the office at No. 48 South Third Street, formerly occupied by the Western Union Telegraph Company.

.... The revised schedule of message rates issued by the Western Union Telegraph Company went into effect Thursday. This new schedule embraces many radical reductions. Officers of the company explain that in pursuance of their policy of making their tariff list uniform, reductions of from 15 to 30 per cent. have been made in the charges for messages sent to and from Southern points. For instance, rates that have heretofore been 75 cents are now 60 cents and rates that were formerly 60 cents are now 50 cents. The highest rate now on the Western Union list is $1.07, which is the charge for a message of 10 words sent from ocean to ocean. The reduced rates on night messages, which were announced several days ago,

.... During the recent earthquake in England no earth currents were observed on the telegraph lines in any part of the country—a circumstance very unusual in such cases.

.... Promptness of service is quite as important a factor in securing the patronage of the public as low rates. We hear of several business men who are testing the merits of the several telegraph companies as to superiority in this respect, with the intention of governing themselves by the result. A few cents difference in the price of a message is of secondary importance to a business man, compared with that of reducing the time between its receipt by the telegraph company and its delivery at the other end to a minimum.

.... The first cable, built by the Atlantic Telegraph Company from Ireland to Newfoundland, was completed on August 5, 1858. The second was completed from Ireland to Newfoundland in the fall of 1866. The third, between the same points, was also completed in 1866. The fourth was laid by the Société du Cable Transatlantique, and was completed in 1869 from Brest to St. Pierre and Duxbury. The fifth was laid from Ireland to Newfoundland, and was finished in 1873. The sixth was laid between the same points, and finished in 1874. The seventh by the Direct United States Cable Company, was finished in 1875. The eighth, laid by the Compagnie Francaise du Cable Transatlantique, was completed in 1879. The ninth and tenth, laid by the American Telegraph and Cable Company, were finished in 1881 and 1882.

.... About twelve years ago, a company was formed for the purpose of establishing telegraphic communication with a floating signal station anchored in the English Channel. This station, which was situated about seventy miles from the shore, at a shoal known as the "Admiralty Patch," was for some little time in successful operation, but owing to the continual breakages of the cable which took place, the enterprise had eventually to be given up. The failure was due to causes which are quite capable of being got over. The floating vessel was unsuited for the purpose and too faithfully answered to its name, the Brisk, the result being that the cable continually fouled the mooring chains and broke. Had a vessel been specially designed for the purpose and the cable been interwoven with a chain of special construction, it is probable that a commercial success, instead of a failure, would have been attained. The advantages of such floating stations are so obvious that they do not require to be brought prominently forward; indeed, at the time the formation of the "Mid-Channel" Company was suggested, the idea was quickly taken up and the capital was soon subscribed.

The Telegraph in Spain.

Official statistics of the Spanish telegraphs show that the total number of stations opened to the public on December 31, 1883, was 647, of which no less than 260 were opened last year. The towns which made the most use of the service in proportion to the population were Madrid, Biscay, Barcelona, Guipuzcoa, Santander and Cadiz, the proportion being less than two of the inhabitants to a dispatch; Seville, Valencia, Malaga, Mercia, Valladolid, Alicante, and the Baleares, with less than four inhabitants to a dispatch; and Tarragona, Zaragoza, Corunna, Alava, Almeria, and Huelva, with less than five inhabitants per message. The number of messages dispatched to the principal foreign countries was as follows: 134,918 to France; 41,938 to England; 23,129 to Portugal; 11,718 to Germany; 8,249 to Italy; 7,576 to Gibraltar; 3,870 to the United States; 3,679 to Cuba: 3,540 to the Netherlands; 3,176 to Norway, and 3,170 to Belgium, the next in order being Switzerland, Russia, Sweden, and Austria. The number of foreign telegrams received was approximately the same. The net amount received by the State as the result of the year's working is returned at £106,727.

The Bankers and Merchants'. Telegraph Company in Boston.

DESCRIPTION OF THE NEW QUARTERS OF THE COMPANY IN THE RIALTO BUILDING.

A dozen years ago when one wanted to use the telegraph a walk of several squares, or perhaps a mile or two, to the company's office was necessary, and with those persons whose business required the frequent use of the wires the employment of a boy, principally for the purpose of running to the telegraph office, was far from uncommon. To-day, when a man of business wishes to send a message he turns a little crank attached to a small iron box on the wall, which makes the impression of the number of the box on a piece of tape at the telegraph office, and in no more minutes than are required for a boy to run to the place whence the call came the message is in the company's hands, without the sender having had to leave his counting-room. This system has robbed the telegraph office in cities like Boston of much of their old prominence, just as the carrier service always kills the popularity of the post offices in the little cities which have grown to sufficient importance to merit the adoption of the system.

For this reason the announcement that the Bankers and Merchants' Telegraph Company has heretofore had its main office at No. 46 Devonshire street, will be as much news to hundreds of the company's most liberal patrons as will the further announcement that, on account of its increased business, the company to-day opens in more roomy quarters in the Rialto Building, No. 141 Devonshire Street, corner of Milk. The new offices were formerly occupied by the Elliot National Bank, and they comprise the basement and first floor. A pedestrian passing along Milk or Devonshire Streets could not help observing the striking signs that have been placed over the windows of the first story, reading "Bankers and Merchants' Telegraph Company," in white embossed letters, with gilt edgings, on a blue background.

The entrance for the messenger boys is on Milk Street, and the first room on the right of the stairs leading to the basement is the messengers' uniform room, where, upon going on or off duty, the boys make a change of clothing. The other departments in the basement include an enclosure of wire netting for the delivery clerks, and the tool room and waiting room of the linemen. Next to these comes the battery room, containing 2,800 jars. The supply department room for blanks, etc., is in the front of the basement. The book-keepers' room adjoins the supply room, and here messages, and copies of messages, are to be stored. These messages and copies, after being kept three years, are taken in charge by some official of the company and taken to the paper mill with which the company has a contract, where, in the official's presence they are thrown into a "picker," after which, of course, the writing on them is beyond deciphering.

The receiving room is on the first floor, and is entered by new double doors at the southeast corner of the building. A more elegantly carved counter cannot be seen in Boston. It is of mahogany, with variegated marble panels, and it cost over $6,000. Over the two receiving windows, as well as the cashier's and manager's windows, are silver plates bearing the names of the different departments. Behind the counter is the operating room, with a capacity for fifty operators. The appointments of the room, including the rose-stained chairs and the operators' quartet tables, are very complete, and surpass even those of the company's New York office.

The inside wire work was done almost entirely by Mr. James E. Wilson, formerly with the telephone Company at Boston, and is very creditable to him.

Twenty-two wires, including eight duplexed ones, run to the metropolis. The company has lines extending from Chicago to Kansas City and Leavenworth, and one is now being built between Pittsburg and Chicago.

Death of George W. Trabue.

George W. Trabue, General Superintendent of the Southern Division of the Western Union Telegraph Company, died at the Coleman House in this city from brain fever on Friday morning last. He arrived here from Nashville a few days ago. He had been in poor health for some months, having been troubled with insomnia.

The Age of Wire.

"Future annalists may well describe this period of American history as the wire age," says the Boston *Advertiser*. "In no part of the economy of our daily life are we divorced from wire. It is our slave, and yet an ever-present master. Sleeping, we repose on wire mattresses. Eating, we see foods that have passed through sieves and which are sheltered from insect appetite by wire covers. Calling, we pull wires to ring curled wire gongs. Traveling, we are conveyed by cable or electric railways, hoisted by elevators hung on wires, and hurried over wire bridges. We announce our coming by telegraph or telephone wires, and we tread our way by night through streets lighted by means of electric cables. Across our fields are strung many thousands of miles of barbed wire fences, against which dumb brutes protest, Texas rangers draw the knife, and lawyers, juries, judges, and reporters whet their intellectual blades. Our clocks are set by wires, our watches are run by wires, our books are stitched by wire, our pictures are hung by wires, and our politics are managed by wires."

The Chinese and the Telegraph.

The Chinese Government is now engaged in constructing a line of telegraph from Canton to the borders of Tonquin, crossing the two provinces of Kwang-tung and Kwang-si. A good deal of opposition was experienced in making the Hongkong-Canton line; the wires were torn down, the posts were pulled up, and the men engaged in the work of construction were repeatedly driven away by the mob. Similar, or even more determined, opposition was anticipated in connection with the works now in progress, for the people of these two provinces are noted for their bitter antipathy to foreigners and foreign inventions. It is, moreover, popularly believed that the telegraph must seriously interfere with the good luck of the land it crosses. The Government, however, caused numerous placards to be previously posted in all the towns and villages through or near which the line of telegraph would pass, informing the people of its value to the Emperor in the difficulties which had arisen, and strictly charging them not to interfere in any way with its construction. A band of about one hundred soldiers are engaged in the work, under the superintendence of three Danish engineers; and as yet no opposition whatever has been met with. The work, however, is proceeding slowly; it was commenced upwards of a month ago, and has but just reached the first city in the province of Kwang-si; it will take a month or five weeks longer to complete the line to the Tonquin frontier. It is not at all surprising that the telegraph should be a source of continual wonder to a people so ignorant of science as are the Chinese. Little knots of people may frequently be seen gathered round a post listening with gaping astonishment, but with the fullest confidence, to some wiseacre who is pretending to explain the *modus operandi*. He tells them that there is a devil in each post, that the posts are placed close enough together for the devil in one post to make himself heard by the devil in the next, that the wire is placed on the top of the posts merely to keep them in an upright position; anything of a slant would make the devil inside feel very uncomfortable. These devils, of course, speak a language which is both unintelligible and inaudible to the uninitiated. "Foreign devils," however, understand it well, and so to send a message is a very simple thing. A "foreign devil" speaks it to the devil in the first post; he passes it on to the next, and so it reaches its destination, where another "foreign devil" receives and interprets it.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, MAY 10, 1884.

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Electric headlights are coming into use for steamboats on the Mississippi and other southern rivers. Why should they not be equally serviceable and desirable on the North and East Rivers, and on Long Island Sound?

The recent decision of the Supreme Court that decisions of the Commissioner of Patents cannot be reversed by the Secretary of the Interior, is going to open up some interesting and intricate questions, especially in matters pertaining to electrical patents.

Carbon manufacturers have made commendable progress in their art, and competition has brought the price down within reasonable limits, but there is still much to be desired in the way of quality, and it is our belief that experiment, experience, and competition will yet achieve it. By the way, what has become of that "permanent carbon" of which so much was said a few months ago? The report was that it was an established fact, that it had been thoroughly tested and found practically incombustible, but since that time nothing has been heard from it. Why keep so important and valuable a discovery hid from the public?

It is whispered that Boston's Lamp Committee is disposed to be contrary about the electric lights, and to take the ground that although the City Council has voted an increased appropriation, they are in no way bound to expend it. "Whom the gods would destroy they first make mad."

We notice that the trial of the Drawbaugh case by newspapers still continues. Should we add our voice to the discussion, it would be to say that the decision in this famous suit is to be rendered by the courts, and that all this newspaper talk is just so much time and ink wasted. One man's guess is as good as another's, but the judge is the only man whose guess is going to count. Wouldn't it be well to wait until he speaks?

It is clear that an era of cheap telegraph rates is upon us. Competition produces its inevitable results, prices go down below the paying point, until, tired of wasting money, the competing companies agree upon some standard, which, however, is always lower than that in vogue when the fight began. Meantime the public has learned to use the wires more than ever before, the volume of business has been increased, and another "lap" has been scored in the march of progress.

The New England Telephone Company is feeling its way carefully in the matter of underground wires in connection with its Boston Exchange, and is getting very satisfactory results. Of course obstacles and difficulties present themselves, one after another, but thus far these have been successfully overcome, and it is believed that the same success will attend the further extension of the system. It is a long step in the right direction when one hundred wires can be carried in an underground cable to a distance of three or four thousand feet from the central office, and diverge from that point to the offices and dwellings of subscribers. The Patterson cable is used exclusively for underground work, and so far gives excellent results.

The wires were fairly kept hot during the latter part of last week with messages carrying the hourly record of the walking match in this city. Like the record of ballots at a national convention, such messages, giving the news in a nutshell, are looked upon in a measure as public property. They are taken off by operators at way stations, "tickers" cease their more serious work to print them, they are bulletined and telephoned, until, in an incredibly small space of time, they are disseminated far and wide over the country, and everybody knows their contents. In the case of a walking match record their intrinsic importance is, of course, small, but they serve to show how complete are the means of intercommunication in this country, and how thoroughly every part is linked to every other part by bands of iron.

The Assembly of this State has practically passed the bill requiring wires to go under ground on or before a certain fixed date—November 1, 1886, if we are not mistaken. We fully expect to see a very large number of wires under ground before that date, but we do not expect to see the air above us entirely free from wires by that time or for a long time afterwards. Of course, we know that many of our contemporaries will hold up their hands in holy horror at the mere suggestion of an idea that a single wire will be allowed to remain overhead a single day after the date fixed by the law, but we shall see. We incline to the opinion that, when it comes to deciding between wires overhead and electric lights at present prices, or wires under ground, resulting either in no electric lights at all or lights at double present prices, the people will have something to say about it.

It would be very interesting to get at the loss which an ordinary iron wire loses in conductivity every year by loss of substance from rusting. After the sleet storms of this winter we saw broken wires which showed only a small central core of solid iron, hardly larger than the lead of an ordinary pencil, the balance of its substance being honeycombed by the action of the elements. Of course, such a wire was very low as to conductivity, and very weak as to tensile strength. It may be that the particular wire in question was so placed as to be specially exposed to this deterioration, and it may be that it had been in the air for an exceptionally long time; but in either case its condition was an argument in favor of copper wires, which, owing to the present phenomenally low price of ingot, may now be had cheaper than ever before.

The peace of the City of Brotherly Love is disturbed just now by unseemly contention, brought about by the establishing of a miniature telephone exchange by the Clay Commercial Telephone Company. This act led the Bell Company to issue a warning notice to the Clay Company's platoon of subscribers, whereat the Clay Company issues a circular to its clients, in which it waves the tomahawk and sounds the warwhoop, and also, we regret to say, offends the peace, dignity and good name of the City of Penn by the false statement that "the United States Court for the Eastern District of Pennsylvania, at Philadelphia, after full argument a few weeks ago, refused to grant to the Bell Company an injunction, as prayed for by them, to restrain a competing company." That is exactly what the Court did not do. It is exactly what the Court declined to do. The Court postponed giving any decision whatever, and gave excellent reasons for its non-action. The Clay Commercial Telephone Company should remember that nothing is so beautiful as exact truth.

While the large number of electrical patents issued every week gives unmistakable evidence of the industry and numerical strength of the workers in this promising field, close examination shows that in all probability one-half of the patents issued cover devices which, for one reason or another, have no commercial value whatever. So great is the fear of inventors that some one will get in ahead of them, that they rush to the patent office with their ideas only half worked out, and lay the incomplete results before the world. Of course a lot of bright minds immediately take the work up, carry it out to completion, and one or more of them gets a patent for an improvement which is so much more valuable than the original grant that the holder of the latter finds that he has had his labor for his pains. A little more deliberation in such cases would be greatly for the good of the inventor, and would certainly do something to reduce the number of valueless patents which are pouring out of the Patent Office in a continuous stream, giving rise to endless litigation which keeps inventors poor and tends to discredit even the best patent as a piece of property.

Of all inventions, old or new, the telephone is the one that has most rapidly come into use the world over. Its most rapid progress has naturally been in this country, the land of its birth, partly because it was here that it was invented, and partly because Americans are quicker to see the advantages of a new thing and put it into practical use than the more conservative people of the Old World. That the increase in the territory covered by the telephone will be as great during the coming three or four years, will be as rapid as it has been during the three or four last past is not to be expected, because the available and desirable territory has been very largely taken up, but a steady increase in the number of telephones in use may reasonably be expected for many years to come, because much of the territory is but sparsely occupied, and from all the companies operating exchanges come reports of a constant increase in the number of subscribers. The telephone business of this country is like a tree with many branches. Its annual growth does not show in additional height gained to the extent that it did when a sapling, but the aggregate growth of all its branches is more in bulk every year than was the tree itself in the day of small things.

It is about time that some very plain words were spoken—and spoken very loud, indeed—about the careless, shiftless, and slovenly way in which some of the wiring has been done in this city for arc lights. We have in mind instances in which the wires are carried from the roof of a low building on one side of a street, directly across the street downwards to the level of the second story on the opposite side—that is, to a point scarcely more than twelve or fifteen feet above the sidewalk. In many instances, wires so strung cross the streets diagonally, and hang in loose loops which endanger any unusually high vehicle that may come along. No wonder the people complain; no wonder there is an outcry against such work. If, instead, the wires were carried across the street at the level of the housetops and stretched tight, then let down the front of the building and carried out to the lamps suspended from substantial iron frames, there would be no danger, they would not offend the eye, and there would be no good ground for complaint. All electric companies know and admit that their wires are at best a necessary evil, and if they be at all wise they will see to it that their linemen do their work in such a way as to reduce the evil to a minimum.

MAKE THEM BIG.

Pneumatic tubes are destined to play a very important part in the near future, especially in connection with telegraphy, as the indications are that the leading companies will use them to a considerable extent in large cities in gathering in messages from sub-offices, and in distributing them to such offices for delivery by messengers. It is believed that more prompt and satisfactory service can be obtained by sending messages to the central office by tube, for transmission thence by wire, than by the present system, and that it will also prove in the end cheaper to "take off" incoming messages at the principal office and "tube" them to sub-offices for delivery. If tubes can be and are to be such an important adjunct of the telegraph service, it can readily be seen that it will not be long before the district messenger companies will find it greatly to their advantage and that of their customers to employ them between certain stated points, when it is desired to transmit written messages over a considerable distance in a limited time. And if the messenger service is to use them, as it almost certainly will, so will the Post Office department for the rapid transmission of letters from one part of the city to the other, in a set of tubes specially provided for the purpose. And it may reasonably be expected that there will be some private tube lines, just as there are private telegraph and telephone lines. We merely mention these matters so that when the grand digging-up time comes, and all the present gas pipes, water pipes, and steam pipes are taken up and put into the grand subway that is to contain not them alone, but all the electric wires of every name and kind, room may be provided for a liberal allowance of pneumatic tubes. And it would be better, in order to provide against possible needs, to arrange also for a double-track railway. Subways come high, but if we have got to have them, let us have them big enough.

ELECTRICITY AFLOAT.

Probably nothing aboard a ship conduces more to seasickness than the smell of the oil lamps. Gas, to be sure, can be used, but it is so dangerous that the underwriters object to it.

It was for this reason that such enterprising people as the Transatlantic steamship companies made a trial of electricity. That it proved a success from the very start we all

know. Indeed, it proved to be far more successful than was expected, so far as expense is concerned.

One of the first, and hence one of the most interesting, experiments was made on the Inman line steamer City of Berlin. Five years ago she was fitted with a W. 3 Siemens' alternating current machine, a four horse-power engine, and four Siemens' differential arc lamps. This number was afterwards increased to sixteen.

But in 1881 Mr. Swan, having introduced his incandescent lamps, they were tried aboard the steamer City of Richmond, and later on the City of Rome, of the Anchor Line—the latter with incandescent lamps in the cabin and arc lamps in the engine room and steerage.

At the present time there are six thousand incandescent lamps afloat, and it is safe to say that every steamship launched in the future will be fitted with electric lights.

The largest and handsomest installation of incandescent lamps afloat is undoubtedly to be seen on the new Cunard steamer Aurania, which has five hundred and fifty. When she reached New York a little over a week ago, she seemed all aglow inside. Her main saloon almost dazzled the beholder, and every state-room, every nook and cranny, was as light as though it were yet broad day instead of inky darkness without. Nor need those who travel aboard steamers lighted by these incandescent lamps have any fear of fire. It would be impossible for incandescent lamps to set anything afire, for the very good reason that the only way to get at the light would be by breaking the globe, and should you break the globe there would be no longer any light, for the combustion of the carbon filament would be instantaneous. Then, again, it requires no care whatever. All you have to do when you want light is to turn on the current, and when you have had enough turn it off.

There is no odor from it, and so little heat as to be inappreciable. It does not flicker nor alternate in intensity. When it shall have become as popular ashore as it is afloat, there will not be any more deaths from asphyxiation in the various hotels. Countrymen may try to blow out the electric light to their hearts' content; it will not be put out, how hard soever they may blow. If it could be blown out, the gas companies would have doused it long ago, for they almost exhausted their energies in trying to show that it was useless. They said a great many hard things against it, but up to date they have not charged that it smelt bad or was poisonous—two qualities which their own noxious fumes possess to a somewhat phenomenal degree.

A VAST FIELD FOR RESEARCH.

It is all very well to say that we are passing out of the Age of Steam into the Age of Electricity, but it will by no means answer to assume that we have attained final results in the matter of steam. On the contrary, our actual results attained, compared with what theory shows to exist, are so insignificant as to be almost humiliating. Of excellent engines there is an abundance, engines which deliver a very creditable per centage of the power represented by the steam put into them; but when it comes to the power which that steam shows as compared with the power which the fuel consumed ought to show, we are simply *nowhere*. Of course there are some boilers and furnaces which give far better results than others for the same fuel consumption, but there is not one that gives anything like an adequate return, and hence the whole process of steam making, as now practiced the world over, is, under the best circumstances, wasteful and extravagant to the last degree. Engineers hold up their hands in holy horror at the absurdity of expecting any practical result from a storage battery which will not return more than fifty per cent. of the electricity put into it, or from a motor which will not deliver over the same proportion of the power used to create the electricity which drives it, but they know perfectly well that the man who could produce a boiler that would deliver in steam one-half of that percentage of the power contained in the coal burned under it would have a fortune in his hands whose value would surpass computation.

Here then, is a problem for "bright minds," a problem which deserves more attention than it is receiving, and which it will pay handsomely to solve. The heating power is in the coal, but we burn it in such a way that the heat is dissipated, lost, and wasted, and every horse-power actually delivered by the engine represents several times that force in the fuel consumed to produce it.

The importance of the economical production of power can hardly be overestimated. It would cheapen by just so much the production of electric lights of all types, it would go far to solve the motor problem, and it would remove one serious obstacle to the use of storage batteries.

We know that there are many inventors who claim to have produced devices which will accomplish just what we have here described as so much desired. We know that there are schemes without and which, on paper, are shown to be sufficient for the purpose. There are so many of them that users of steam are tired of hearing of them. But when the right thing comes along, a system that can show by actual practical experiment that it can attain the desired end, by effecting the desired economy, it will not have to exact attention, for the world will welcome it. Let it demonstrate the truth of what it claims, actually and practically, not by laboratory experiments merely, but on a practical scale and for a long enough time to give results that can be relied upon commercially, and, even in these unspeculative times, it can have all the capital it wants to back it. What is wanted, as a starter, is a means of burning coal which will, for the same amount of fuel, give two horse-power where only one is given now. It is in the coal, and a good deal more, and unless there is some very good reason not yet known to the contrary, it ought to be gotten out.

NO ROYAL ROAD.

We are in receipt of the following communication:

To the Editors Electrical Review:

My taste inclines towards a knowledge of electricity, but my means will not admit of any extensive course of study. I would like to know of the best works on the subject, elementary in character, works free from "ohms," "webers," "volts," "amperes," etc., unless a clear explanation of the meaning of such terms is given. My last purchase is about as much value to me as a Greek testament would be. I desire a clear and comprehensive book on electricity.

SUBSCRIBER.

If, to take "Subscriber's" own comparison, a student were to begin the study of Greek by purchasing a Greek testament, we fancy that he would make but very little progress in the language, but if, before doing so, he were to procure and study a Greek grammar very carefully for a few months, and then, with a lexicon by his side, were to take the testament in hand, he would find that it was not so incomprehensible after all. Now it is true of electricity as it is of Greek that there is no royal road to learning. "Subscriber" must not expect to attain a knowledge of the science by mere desultory reading. He must *study*, and study hard, just as he studied, or should have studied, when at school. There are plenty of text-books, and until he has been through them carefully and studiously, so as to know the fundamental principles of the science and its nomenclature, it is useless for him to purchase books which are written for those who are assumed to have this knowledge. The words "ohm," "volt," "ampere," etc., are merely units of measurement, just as feet, acres, cords, and gallons, are units of measurement, each of a different kind, and it is clear that books which treat of the measurements of lines, surfaces and bulk must be allowed to take it for granted that the reader has previously prepared himself by a thorough understanding of the meaning of these terms. Books on steam do not stop to describe the exact meaning of the term "horse-power," because their authors assume that the reader knows at least that much, and until he does it would be better for him to leave the book unread.

There is one feature in connection with many works on electricity which is a very serious stumbling block in the way even of those who have earnestly studied to familiarize their minds with electrical terms and principles. We refer to their very general use of the higher mathematics, especially of the calculus. It is unreasonable to suppose that the average student has the time or the opportunity to master this intricate though useful science, and he should therefore be grateful to any one who shows how results may be reached without its use. This service has been rendered by Mr. Lockwood, in his little book on "Electrical Measurements and the Galvanometer," and while it does not by any means cover or pretend to cover the whole field of electricity, it will give the beginner a clear insight into the nomenclature and method of electrical measurement, and its mathematics do not rise above the capacity of any one who has mind enough to grasp simple propotion It is a small volume, and can be *read* in an evening, but if "Subscriber" will get it and *study* it, say for a month, until he has *learned* all that it contains, he will never again have occasion to complain that books on electricity are unintelligible to him because they deal in "ohms," "volts," and "amperes."

More about the "Providence System."

To the Editors of the Electrical Review:

In the issue of your paper of the 3d inst., Mr. Duxbury cites the large number of subscribers in the Providence Exchange as an evidence of the excellence of the "Providence system." I would like to inquire if it is not just possible that low rates have as much to do with it as superior service.

While there is some inconvenience in using numbers on wires on which there are several subscribers, owing to the occasional changes mentioned by Mr. D., it is slight in comparison with the inconvenience of maintaining a large force of operators, each of whom *should* be thoroughly familiar with the name and switch location of every subscriber in the exchange, and the very great annoyance to subscribers and operator alike incident to the employment of a new operator who cannot possibly become familiar with all the subscribers in a large exchange in three months. Any one having a knowledge of the continual inquiry among the ablest operators as to what number so-and-so is, and of the many times the wrong switch is called, can imagine the position of the subscriber (who is substituted for the first operator who receives the call) in the "Providence system," which is only different from most large exchanges using Post, Gilliland or Williams switches in that the subscriber is compelled to repeat the call to the second operator, and in this difference is its inferiority. The system has been tried and abandoned in other cities, and only the superior management, excellent discipline, and more than ordinary ability of operators, coupled with the great powers of endurance of the Providence subscribers, makes it tolerable there.

I am surprised that Mr. Duxbury should so far commit himself as to compare it to a multiple system, and must assume that he has never seen a multiple in operation.

In conclusion I would say, and I think I shall be sustained by every one who has had an actual experience in the operation of multiple systems, that there is no single switch system of more than 150 wires capacity, whereby as satisfactory service can be given as can be given on the modern multiple with half the operators necessary to the single switch system.

DEKKO.

What Was the Matter?

To the Editors of the Electrical Review:

I have been not a little puzzled at a circumstance which came under my observation a short time since, and although I have attempted to theorize a solution, I am far from satisfied.

Having the charge of a large electric lighting plant, my attention was drawn to occasional feebleness of the lights in one of the circuits. I first tested for any undue resistance. Finding no loss in that direction, I next tested for loss of current by escapes, but found nothing. I then made a careful test of the two dynamos (two 25-light dynamos coupled up for a 50-light circuit), but failed to discover any cause for the trouble, so I made up my mind that the presence of the current developed a resistance in one of the lamps. I therefore made a rigid examination, but still failed—I will say here that the number of lamps in the circuit (44) was well inside the generating power. I next went to the station and found the engine working as usual with full speed, the dynamos also being run at the maximum speed, when suddenly my attention was attracted by a gradual retardation of the engine. Here was evidence of the trouble, but what was the cause? There were four Armington & Sims engines side by side, each of 50 H. P. The steam pressure was full, and supplied to the engines from a main pipe into which was tapped the supply pipe for each engine in regular order. The engine referred to was the third from the boiler. The first, second and fourth went at their regular speed, and even the third one would do so generally, but this occasional retardation would set in. In view of the fact that neither the wire, the lamps, the dynamos nor the engine are shown to be at fault, what was the cause of the difficulty? D.

[It is just possible that the two dynamos worked against each other at times, one tending to act as a motor in a direction opposite to that in which it was being driven by the engine. Working them on separate circuits would test this theory. In the meantime we should be glad to hear from any of our readers whose experience will enable them to throw light on the question.—EDITORS REVIEW.]

Heating of Iron Cores.

It is remarked that in certain dynamos the cores of the electro-magnets gradually heat up, and their temperature continues to rise after the machine has stopped working.

Engineering says that various explanations have been offered for the latter peculiarity, one being that the draught created by the machine in working keeps the temperature down by carrying off heat, whereas when the machine stops the draught ceases. Others suppose that the Foucault currents, or the magnetic friction causing heat, do not cease to operate on the stoppage of the machine. The cause of the heat, whether magnetic friction or Foucault currents, is a moot point, and MM. Warburg and Honig have recently made experiments which lead them to conclude that it is mainly due to magnetic friction. A core of iron was carefully magnetized by a coil, and the heat generated was exactly measured in an ice calorimeter. If the heat depended only on the electrical resistance of the iron to the circulation of Foucault currents, and if the coercive force of the iron was zero, the authors argued that they could calculate the heat generated by two cycles of magnetization. This they did; but the calorimeter showed a very different result, and MM. Warburg and Honig have been led to the conclusion that nearly 75 per cent. of the heat generated is due to magnetic friction.

According to the *Japan Weekly Mail*, Celestial fishermen cut the cables in Chinese waters in order to steal and sell the enclosed wires. It is said, too, that the natives of Alaska have utilized for fishing the wires that have been abandoned to their tender mercies.

The Cotton Exposition.

DESCRIPTION OF THE BUILDING IN WHICH THE EXPOSITION WILL BE HELD AT NEW ORLEANS, LA.

In his plan for this great exhibition building, Mr. Torgarson has sought to secure one vast unbroken level for the display in the most compact and ornate form. In this respect he has succeeded so admirably as to call forth commendatory expressions from the projectors of all former American expositions. He has now produced the largest single room, every portion of which can be seen from any point without obstruction, of which there is any knowledge.

The building is 1,378 feet long by 965 feet wide, covering thirty-three acres, or eleven acres more than the main building of the Philadelphia Centennial Exposition of 1876. There are 1,656,300 square feet of floor space, including the gallery. The reader may form a better impression of the vast dimensions of the structure by imagining three ordinary city squares, or blocks, one way and five the other, covered by a solid roof. And if he chooses to allow his fancy to carry him still further, he can picture a monster panorama of the world's industry, extending before his vision uninterrupted by a single object. The roof, which is being made in Cincinnati, will cover 1,000,000 square feet. The active commercial rivalry of the different sections is aptly shown by the distribution of contracts for the materials. The window sash comes from Milwaukee, Wis. The glazing will be done by St. Louis parties. Four thousand kegs of nails are being shipped from Wheeling, W. Va. Nine million feet of Mississippi lumber will be consumed. A massive and magnificent group in bronze, typical of America, to be placed over the main entrance, is being made at Canton, Ohio; also a statue of Washington and Columbus, and a coat of arms of all the States, which will appear in medallion form, as part of the exterior ornamentation. Exquisitely modeled cornices are being made at New Orleans.

The building will be 60 feet high, with a tower 115 feet high, and the architect has been unusually fortunate in rendering the exterior exceedingly unique and attractive. A platform will be erected on the tower, reached by elevators, from which visitors may have an exceptionally fine view of the City of New Orleans, the exposition grounds, the Mississippi River, and the surrounding country. There will be one line of gallery extending around the entire circumference of the building, to which visitors will be carried by twenty steam and hydraulic elevators, representing all the manufacturers of these conveyances in this country. The Music Hall, situated in the center of the building, will be 364 feet wide, and will comfortably seat 11,000 persons. The platform is being built for 600 musicians. To light the building with incandescent lamps will require 15,000 lights and 1,800 horse-power. To light with the arc system will require 700 lamps and 700 horse-power to operate the dynamo. The total steam required for lighting and for Machinery Hall will be at least 3,000 horse-power. In this estimate is included the power for five arc lights of 36,000 candle-power each, which will light the grounds. These are the largest single lamps ever constructed. The building will be in complete readiness for the reception of articles intended for exhibition by the middle of August.

For the purpose of registering trade marks in Mexico, application must be made to the Ministro de Fomento (Department of Public Works) for permission to register the trade mark, which should be accurately described, as well as the articles thus protected, with the address in full of the proprietor. These copies of the trade mark should be enclosed, and a certificate from the resident Spanish Consul as to the proper legal right of the proprietor to the trade mark, or else some convincing proof of his proprietary rights A second certificate should be enclosed if the application is made through an agent, setting forth his agency.

Interior African Sea.

Many persons have supposed that the French Commission, which was appointed to examine De Lesseps' project condemned it, but this is a mistake. The Yellow Book, published by the Ministry of Foreign Affairs, shows: 1. That the exactness of the scientific labors on which the project is based is beyond all question. 2. That the execution of the canal which is to be the feeder of the future sea presents no difficulty. 3. That the work would be durable, since, even if we admit the most unfavorable hypotheses with regard to evaporation and saturation, the sea would have an assured existence of more than one thousand years. 4. That in no point of view could the sea be injurious, but that on the contrary, it would favor the development of colonization, by ameliorating the climate, diminishing malaria, and increasing the fertility. 5. Opinions have been divided as to the importance of the new route, which would be opened to commerce, to the industry and security of Algeria; however, no one has been able, from any of these points of view, completely to deny the utility of the submersion of the basin of the Chotts. General Favé and others have eloquently set forth the capital importance of the interior sea, as well in a colonial as in a military point of view.—*Comptes Rendus.*

The new Guion steamship Oregon has just beaten all previous records, her actual time between the two points above mentioned being 6 days 10 hours and 10 minutes. Her best day's run during the voyage was 472 miles, and her poorest 440. Her average was 450 miles a day, or nearly 19 miles an hour. According to the log of the Oregon, she traveled in all 2,861 miles. This is 100 miles more than was made by the Alaska on her quickest voyage. The days' runs of the Oregon were as follows: April 14, 440 miles; 15, 460; 16, 455; 17, 470; 18, 469; and 19, 472.

The following figures in regard to boilers are taken from W. G. Hamilton's book, "Useful Information for Railway Men," compiled for the Ramapo Wheel and Foundry Company, and relate to an ordinary horizontal flue boiler:

"One actual horse-power equals 33,000 pounds raised one foot in one minute. Applied to steam engines, it is the mean steam pressure on the piston, in pounds, multiplied by the velocity of the piston in feet per minute divided by 33,000. From this deduct 25 per cent. in condensing engines and 18.1 per cent. in high pressure for working friction and pumps, and the balance will be the actual horse-power."

One horse-power in a *boiler* is its capacity to generate enough steam in one minute to raise 33,000 pounds one foot. The capacity of a boiler to generate steam is, of course, governed by the form of the boiler, whether tubular or not, and whether the boiler and its flues or tubes are horizontal or vertical.

"In boilers for each horse-power there is required:

1 cubic foot of water per hour.
1 square yard of heating surface.
1 square foot of fire-grate surface.
1 cubic yard of capacity.
28 square inches of flue area.
18 square inches of area over bridge wall."

Making Carbons.

Editor Electrical Review:

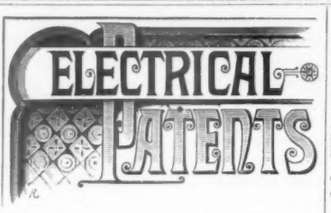
Will you kindly inform me what kind of paste or substance is mixed with powdered carbon to make it in a mass for moulding and baking? I refer to any kind of carbons, electric light battery, etc., and greatly oblige,

Yours, truly, W. W. SPLANE
National Transit Company,
Bradford, McKean county, Pa.

ANSWER.

Cheap molasses, or sugar, or petroleum residuum, or any cheap carbonaceous substance which gives the desired *pasty* condition.

The Buckeye Engine Company, of Salem, Ohio, are now employing 200 hands, running a portion of the time nights.



INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING APRIL 29, 1884.

297,578 Telephone transmitter; Daniel Drawbaugh, Eberly's Mills, Pa., assignor to the People's Telephone Company, of New York.

297,579 Telephone transmitter; Daniel Drawbaugh, Eberly's Mills, Pa., assignor to the People's Telephone Company, of New York.

297,580 Electric arc light; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York.

297,581 Incandescent electric lamp; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York.

297,582 Dynamo-electric machine; Thomas A. Edison, Menlo Park, N. J.

297,583 Dynamo-electric machine; Thomas A. Edison, Menlo Park, N. J.

297,584 Dynamo-electric machine; Thomas A. Edison, Menlo Park, N. J.

297,585 Incandescing conductor for electric lamps; Thomas A. Edison, Menlo Park, N. J.

297,586 Electrical conductor; Thomas A. Edison, Menlo Park, N. J.

297,587 Dynamo-electric machine; Thomas A. Edison, Menlo Park, N. J.

297,626 Indestructible compound for coating wires for electrical purposes; Joel H. Page, Philadelphia, Pa., assignor of one-half to Blanch Carrie King, same place.

297,669 Apparatus for electroplating; Charles F. Brush, Cleveland, O.

297,677 Device for attaching telegraph wires to posts and insulating them therefrom; Herbert Cottrell, Newark, N. J.

297,683 Telephone line; Thomas B. Doolittle, Bridgeport, Conn.

297,688 Telephone cable; Franz C. Guilleaume, Cologne, Prussia, Germany.

297,699 Pin for electric insulators; John M. Klein, San Francisco, Cal.

297,724 Telephone repeater; Daniel E. Smith, Hartford, Conn.

297,732 Telephone mouth and ear piece; Francis Ware, Boston, Mass.

297,751 Electric door-opener; Jesse H. Bunnell, Brooklyn, N. Y.

297,819 Telegraph key; Charles W. Lewis, Chicago, Ill., assignor to the Western Electric Company, same place.

297,820 Gaso-electric lamp; Johan Hern Loder: Brussels, Belgium.

297,833 Electric arc lamp; Phillip P. Nungesser, Cleveland, O.

297,855 Electric cable; William H. Sawyer, Providence, R I.

297,865 Machine for making insulator pins; William Snee, West El zabeth, Pa., assignor of one-half to Milton A. Walton, Cameron, W. Va.

297,866 Electric regulator; Elmer A. Sperry, Chicago, Ill.

297,878 Dynamo-electric machine; Charles J. Van Depoele, Chicago, Ill.

297,879 Combined electric lamp-lighting and extinguishing device; Henry Van Hoevenbergh, Elizabeth, N. J.

297,909 Telephone station apparatus; Edward M. Bentley, Brooklyn, N. Y.

297,924 Apparatus for the production and utilization of secondary electric currents; Lucien Gaulard and John Dixon Gibos, 18 Warwick street, Regent street, county of Middlesex, England.

297,926 Underground conduit for electric wires; Christian H. Goebel, Philadelphia, Pa., assignor to the Goebel Sectional Electric Underground and Pneumatic Delivery Company, of New Jersey.

297,927 Conduit for electric wires; Christian H. Goebel, Philadelphia, Pa., assignor to the Goebel Sectional Electric Underground and Pneumatic Delivery Company, of New Jersey.

297,928 Electric cut-off; Christian H. Goebel, Philadelphia, Pa, assignor to the Goebel Sectional Electric Underground and Pneumatic Delivery Company, of New Jersey.

297,929 Underground conduit for electric wires and pneumatic tube combined; Christian H. Goebel, Philadelphia, Pa., assignor to the Goebel Sectional Electric Underground and Pneumatic Delivery Company, of New Jersey.

297,937 Heat regulator; Warren S. Johnson, Whitewater, assignor of one-half to William Plankinton, Milwaukee, Wis.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

BUSINESS NOTICES.

A. C. NORTHROP, Waterbury, Conn. Iron and Brass Machine Screws, Zinc in Sheets and Plate for Electrical Purposes, Parts for Telephone and Telegraph Instruments, Manufactured from Iron, Brass, Steel or Zinc.

A. G. DAY, Kerite Insulated Telegraph and Telephone Wire and Cables; Anti-induction Kerite Telephone Cables, CLARKE B. HOTCHKISS, New York. Send for circular and prices.

ALFRED F. MOORE, Philadelphia, Pa. Telegraph, Telephone; Electric Light, Office, Line and Annunciator Wire.

AMERICAN BELL TELEPHONE CO., Boston, Mass, Electric Speaking Telephones for Exchange Systems, Private Lines, and Speaking-tube Lines.

AMERICAN ELECTRICAL WORKS, Providence, R. I. Patent Finished Insulated Electric Wires, Telephone and Electric Cordage. Electric Light Wire, Magnet Wire, Patent Rubber covered Wire, Aerial and Underground Cables, &c., &c. Send for prices.

AMERICAN INSULATOR COMPANY, New York. Insulators of all sizes.

AMERICAN SPIRAL TELEPHONE WIRE CO., Boston, Mass. Spiral Telephone Wire for long and short distance Telephoning. Write for information.

ARMINGTON & SIMS, Providence, R. I. Engines for Electric Lighting and general use.

AUSTIN GALLAGHER, New York, Keith Electric Light System complete for Arc Lighting. Stock for sale.

BAXTER ELECTRIC LIGHT COMPANY, New York. The Baxter Lamp.

B. W. PAYNE & SONS, Corning, N. Y. The Payne Single and Double Valve Automatic Engine. Send for catalogue.

BERGMAN & Co., New York. The Bergman and Hald Battery for Telephone and Telegraph purposes. Send for circular.

BOULTON CARBON CO., Cleveland, Ohio. Carbons for Electric Light purposes. Send for quotations.

BROWNLEE & Co., Detroit, Mich. Telegraph and Telephone Poles.

BRUSH ELECTRIC CO., Cleveland, Ohio. Arc Lights and Brush Storage Batteries.

BUFFALO ELECTRIC WORKS, Buffalo, N. Y. Carbon Points and Plates.

BUTLER HARD RUBBER COMPANY, New York. Rubber Insulators and Electrical Supplies of every description.

BUTLER SAFES, New York. Fire and Burglar-Proof.

CHARLES WILLIAMS, JR., Boston, Mass. Call Bells, Electric Bells, District Bells, Switch Boards, Annunciators, &c., &c. Write for quotations.

CHICAGO INSULATING CO., Chicago, Ill. The Fiske-Mott High-resistance Insulator. Send for circular.

CHROME STEEL WORKS, Brooklyn, N. Y. Steel for Magnets a specialty; Chrome Cast Steel.

COE BRASS CO., Torrington, Conn. Brass, Copper and German Silver in every variety of Sheets, Rolls, Plates, Wire, Rods and Blanks or Shells. Pure Lake Superior Copper Wire and Battery Zincs. Write for price list.

CONNOLLY BROTHERS, New York, Patent Attorneys and Solicitors.

CORNELL UNIVERSITY, Ithaca, N. Y. Electrical Engineering.

D. VAN NOSTRAND, New York. Scientific Books. Send for circular.

ELECTRIC STORAGE AND LIGHT CO., Boston, Mass Own patents for Faure's Storage Batteries for territory of Rhode Island, Connecticut and Massachusetts.

ELGIN STEEL TOWER COMPANY, Elgin, Ill. Electric Light Towers.

GILLILAND MANUFACTURING COMPANY, Indianapolis, Ind.

GREAT SOUTHERN TELEPHONE COMPANY, Nashville, Tenn. Gilliland Switchboards.

HARVEY, STAFFORD & Co., Acton, Ont., Canada Telegraph and Telephone Poles.

H. M. RAYNOR, New York. Platinum for all purposes.

HOLMES, BOOTH & HAYDENS, New York. Fireproof Electric Light Wire, Patent "KK" Insulated Copper and Iron Wire for Telephone and Telegraph use. Send for catalogue and prices.

I. W. COLBURN & Co., Fitchburg, Mass. Dynamo Electric Machines.

IVISON, BLAKEMAN & TAYLOR, New York. Ink of all kinds and colors. Circulars sent on application.

J. O. SHIRAS, Cincinnati, O. Telephone Stocks bought and sold.

JARVIS ENGINEERING COMPANY, Boston, Mass. Boilers set with the Jarvis Patent Furnace.

JOHN H. MUEGGE, New York. Platinum, Chemical Apparatus, Crucibles, etc.

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J. H. BUNNELL & Co., New York. The Morse Learner's Instrument, Telegraph Instruments of all kinds, Telephone and Telegraph Supplies. Illustrated Works on Electrical Measurement, and the Galvanometer and its uses. Send for catalogue.

LAW TELEGRAPH CO., New York. The Law Battery for Telephone and Telegraph purposes.

LOCKWOOD & FOSTER, New York. Learners' Telegraph Instrument.

MUTUAL DISTRICT MESSENGER CO., Boston, Mass. Addressing and Distributing Circulars &c., &c. D. J. Hern, General Manager.

NATIONAL ELECTRIC COMPANY, Washington, D. C. Electrical supplies and apparatus.

NEW ENGLAND BUTT COMPANY, Providence, R. I. Braiding Machinery for covering Telegraph, Telephone and Electric Light Wire, Single and Double Winders and Braiders of every description; also Fine Castings. Send for catalogue.

O. W. MADDAUS, New York. Designer and Engraver.

PAINE & LADD, Washington, D. C. Attorneys in Patent Causes, and Solicitors of Patents.

PALMER WIRE CO., Palmer, Mass., and New York. Galvanized Telephone and Telegraph Wire Iron and Steel Wire of best quality, Material, finish and conductivity. Write for quotations.

PARTRICK & CARTER, Philadelphia, Pa. Electric Annunciators, Learners' Instruments, Batteries and Telegraph and Telephone Supplies. Write for circulars.

PHOSPHOR BRONZE SMELTING CO., Philadelphia, Pa. Telephone Wire, insulated and bare.

RHODE ISLAND TELEPHONE & ELECTRIC CO., Providence, R. I. Manufacturers of the Providence Telephone Switch Boards, Breckenridge Jacks, Wright Cable Clips, Howard Safety Appliances, &c.

ROYCE & MAREAN, Washington, D. C. Dealers in Electrical apparatus, Telegraph and Telephone supplies.

SCHLEICHER, SCHUMM & Co., Philadelphia, Pa Manufacturers of the Otto Gas Engine. Write for catalogue.

THE FREEMAN & ROE ELECTRICAL SUPPLY COMPANY, New York. Electric Light Machines, Motors, Dynamos, Telegraph and Telephone Apparatus.

STANDARD ELECTRICAL WORKS, Cincinnati, Ohio. Manufacturers of Telegraph and Telephone Instruments, Magneto Bells, Switch Boards and Telephone Exchange Apparatus, Annunciators, Wire, Batteries, Insulators, Electric Light Wire and Supplies. Send for circular and prices.

SWAN INCANDESCENT ELECTRIC LIGHT Co., New York. Incandescent Lights, and Complete Apparatus. Send for illustrated catalogue.

THE ANSONIA BRASS AND COPPER Co., New York. Pure Electric Copper Wire for Magnets, Telephone Lines, and Electric Light purposes, Office Wire, Zinc Rods and Battery Copper.

THE BISHOP GUTTA PERCHA WORKS, New York, Gutta Percha Insulated Submarine Telegraph Cables Subterranean Telegraph Cables, Aerial Telegraph Cables, Lead or Hempen covered Torpedo Cables, Lead-covered Cables, Telephone Cables of all kinds —G. P. Office Wire, and Marks' Compound Insulated Wire, &c., &c. Send for catalogue.

THE BUTLER HARD RUBBER COMPANY, New York. Electrical supplies, Rubber Hook Insulators, Hard-wood Tubes, Plug Handles, Lamp Switch Handles, Battery Syringes, etc.

T. H. ALEXANDER, Washington, D. C., Solicitor and Counselor in Patent cases.

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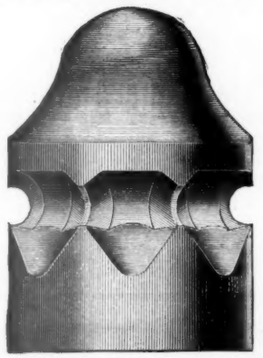

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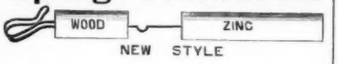

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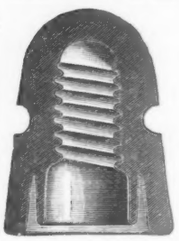

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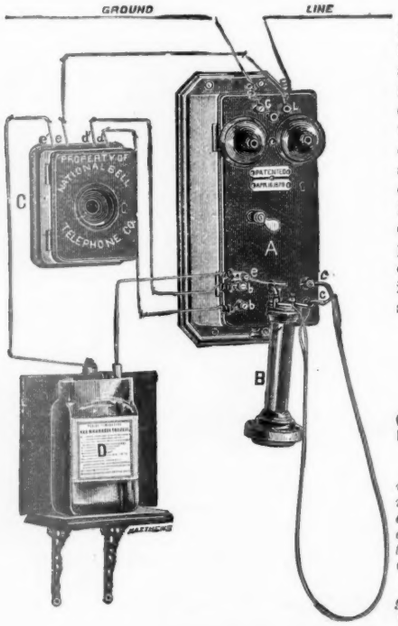

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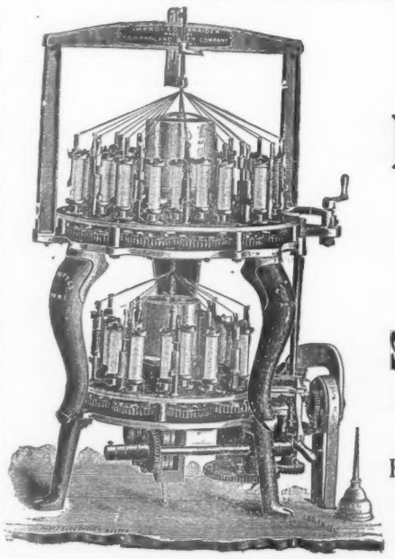

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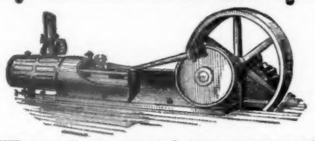

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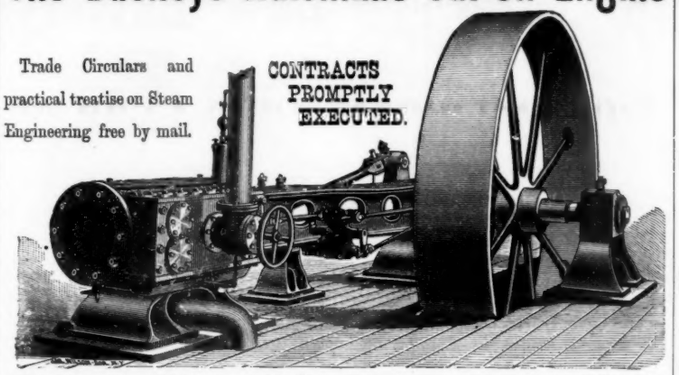

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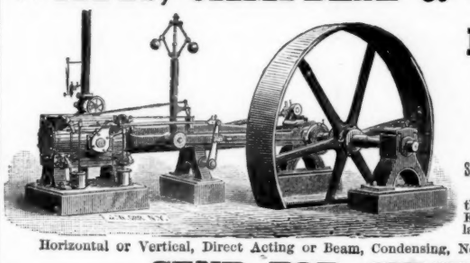

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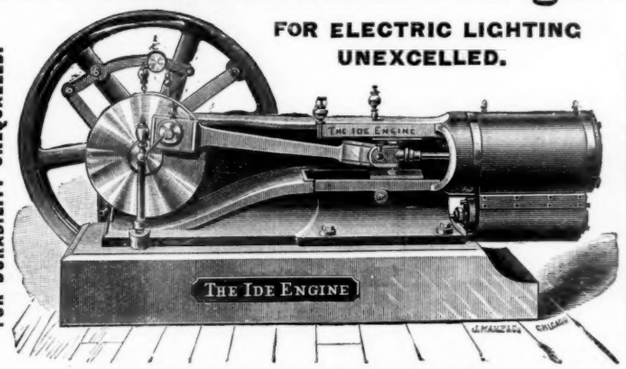

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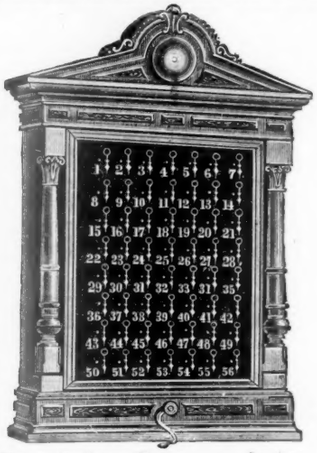

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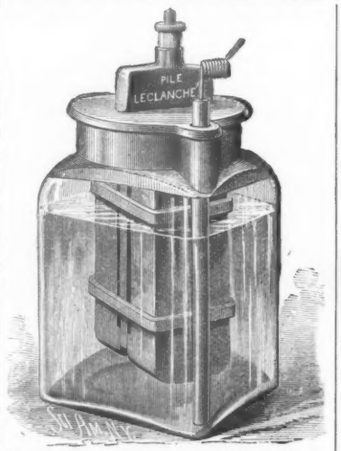

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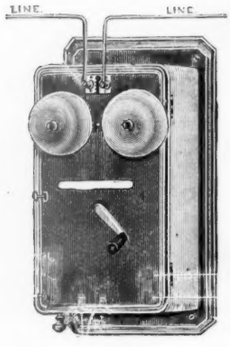

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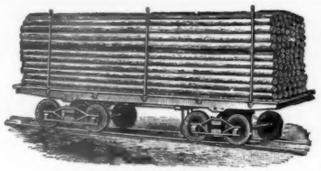

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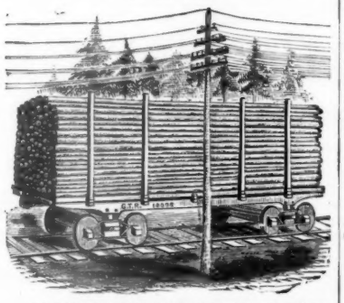

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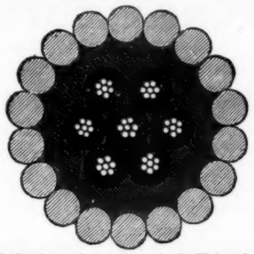

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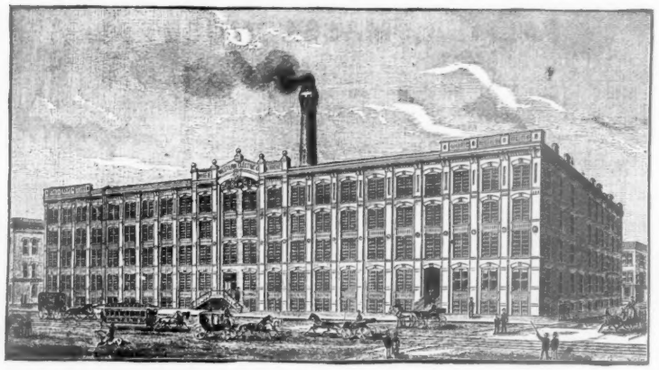

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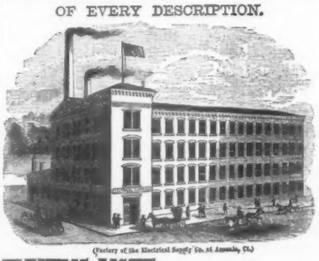

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